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## BRIEFLY TOLD.

NOTES.—

MR. WM. MCSORLEY has been appointed head of the office clerical staff of the Utica (N. Y.) Gas and Electric Company.

MR. JOHN E. BERWIND and associates have sold the plant and franchises of the Fishkill and Matteawan (N. Y.) Equitable Gas Company to Eastern capitalists. The new owners have reorganized the concern under the title of the Fishkill and Matteawan Gas Company, with a capital of $100,000—twice that of the former Company.

SUPERINTENDENT YOUNG, of the Knoxville (Tenn.) Gas Light Company, is busily engaged in carrying out an important addition to its main system. While the plan calls for the placing of pipes in many of the streets of the city proper, the chief extension is for the purpose of giving a gas service in the rapidly developing section known as the North Central district.

AT the annual meeting of the shareholders in the Equitable Illuminating Gas Light Company, of Philadelphia, which is under the domination of the United Gas Improvement Company, the following officers were elected: Directors, James Ball, David H. Lane, I. W. Morris, J. A. Pearson and F. H. MacMorris; President, James Ball; Vice-President, David H. Lane; Secretary, F. H. McMorris; Treasurer, W. A. McEwen; Assistant Treasurer, F. S. Whittaker.

MR. FREDERICK S. JOHNSON, who was prominent in the development of the natural gas interests in and around Lock Haven, Pa., died at his home in Lock Haven the evening of the 26th ult. Deceased, who was in his 76th year, was born in Richie Station, Pa., and was greatly esteemed by his fellow townsmen.

MR. F. L. MARSHALL, formerly with the Seattle (Wash.) Gas and Electric Company, has been appointed Superintendent of the Akron (O.) Gas Company, vice Mr. S. W. Seidell, resigned.

RESIDENTS of St. Anthony Park, a thriving suburb of St. Paul, Minn., to the number of 150, have petitioned the St. Paul Gas Light Company to extend its mains to and through their streets. When President A. P. Lathrop, of the Company, was asked as to whether or not the mains would be continued to the Park, he said: "It is just a question of how much the service will cost and what there is in it. When the engineers go over the ground and make estimates we can tell just what can be done." In this part of the country, if a gas company could readily take on 150 additional consumers, not very much time would be wasted in catering to their needs, provided the expenditure to be incurred was not altogether out of fair proportion to the income that was seemingly in sight. However, it is to be presumed such also is the direction of thought of President Lathrop in the instance of his Company's prospective consumers in St. Anthony Park.

A CERTIFICATE of incorporation has been issued to the organizers of the East St. Louis (Ills.) Gas Company, who recently took over the franchise and plant of the East St. Louis Gas Works. The incorporators are Thomas C. Clark, Rufus S. Dawes and Henry U. Wood. The new concern is capitalized in $1,000,000.

ANOTHER change has been made in the domestic economy and practice of the Peru-La Salle (Ills.) Gas Light and Power Company. Here-


LIBRARY OF CONGRESS AUG 11 1902 SMITHSONIAN DEPOSIT.

after it is to be known as the Citizens Lighting Company, of Peru. The capital stock has been increased to $250,000 from $130,000.

We are indebted to "M. L. H.," of Cleveland, O., for the following:

"Judge Phillips recently rendered a decision adverse to the city of Cleveland, in the mandamus suit brought by Assistant Law Director Baker against Auditor Craig. The question at issue was whether or not the Auditor could be compelled to restore to the duplicate the taxes remitted by the State Board, and whether the court had any jurisdiction in the case. Judge Phillips decided that the Auditor could not be compelled to place the amount upon the duplicate and that the court had no jurisdiction in the case. The result of the decision is, unless the case is decided differently in the higher courts, that the concerned public service corporations will pay taxes only on about $2,000,000 property valuation, which was the amount they returned in 1901, instead of $20,000,000 which the Board of Equalization declared they ought to pay. On July 3, 1901, the City Board of Equalization increased the amounts returned for taxation by several public service corporations nearly $18,000,000. The companies whose returns were increased were: The Cleveland Gas Light and Coke Company $2,374,445.50, the Peoples Gas Light Company $713,755, the Cleveland Electric Illuminating Company $872,118, the Cleveland City Railway Company $5,605,091 and the Cleveland Electric Railway Company $7,291,609. The State Board of Revision, composed of the Auditor of State, the Governor and the Attorney-General, at once met and, stating that the actions of the Board of Equalization were illegal, remitted the several amounts from the tax duplicate. Assistant Director of Law Baker then brought a mandamus suit against Auditor Craig to compel him to put back on the tax duplicate the amount remitted by the State Board. The case was heard before Judge Phillips who holds that the court could not compel the Auditor to place the amount upon the duplicate, in that the court could not interfere with the actions of the legislative bodies unless in case of illegality, its functions being purely judicial. The judge held that there had been nothing illegal in the proceedings of the State Board and that consequently the court had no right to interfere with them by reviewing or revising their action and that he could not compel the Auditor to place the amount remitted from the public service corporations back upon the tax duplicate. 'The power to tax,' said the judge, 'is an incident of sovereignty, and as this is purely a legislative function it belongs to the legislature alone to provide methods of taxation. As there are three branches of government, the juuicial, legislative and executive, none of which can interfere with the functions of the others, the judiciary cannot review the acts of the Tax Board unless there is an irregularity in the legal procedure. The statute nowhere provides for a review by the courts of the action of the taxing boards. Such a review could not be provided for because taxation belongs to another branch of government, the legislative. The County Auditor has done all authorized acts required, and there is no further official duty which the court can order him to do. The amount added to the duplicate was legally removed and anything further is beyond the jurisdiction of the court.'"

## The Substitute for Coal.

The *Journal of Gas Lighting* notes than an interesting answer to the question of what is to be done when the coal capital of the world shall be exhausted, is supplied in a recent letter to *Nature* from Mr. D. E. Hutchins, of Cape Colony. It is to the effect that it will be possible to supply the place of coal by quick growing eucalyptus wood. The position in Cape Town to-day, according to this witness, is that it is cheaper to plough the ground and plant a forest of quick growing eucalyptus trees than it is to import coal from over the sea or by a long and expensive land journey. As far back as 1882, the writer and Sir D. Brandis made the discovery that eucalyptus trees planted over tropical mountains will yield wood fuel at the rate of 20 tons (dry weight) per acre per annum in perpetuity. This wood reproduces itself when cut, without further expense, and is a stronger fuel than coal. The result in question was attained on the Nilgiris, Southern India; but Mr. Hutchins has no doubt that there are other parts where higher yields are produced even now. No doubt, also, when the coal supply is exhausted, selection and experiment will produce a forest vegetation that will yield more than the equivalent of 20 tons of coal per acre per annum. The sugar beet and all the fruits and vegetables of civilization prove how amenable plants are to the moulding of human wants. Why not firewood? Supposing it to be possible to grow 40 tons of firewood per acre per annum by scientific cultivation, and having regard to the extent of tropical lands suitable for the purpose, Mr. Hutchins calculates a total yield of wood equal to 161,000 million tons of coal yearly, which is more than 288 times the world's present coal consumption. On the basis of the actual forest yields of to-day, there would be one-half this gross production. If only one-eighth part of the earth's surface were afforested, the yield of firewood would amount to 20,175 million tons, or rather more than 30 times the world's present consumption of coal. Therefore, it is the prophecy of Mr. Hutchins that when our coal supply is exhausted, and all the useful water powers are appropriated, there will yet remain "that which Englishmen of all the civilized races of the world do most neglect—the forest" as an almost inexhaustible source of fuel.

## Modern Retort House Practice.

[A paper read by Mr. W. B. McLusky at the last meeting of the North British Association of Gas Managers.]

In his circular inviting papers for this meeting the secretary again refers to the "activity which characterizes the present period in the gas industry," as a sufficient reason why subject matter calculated to provoke profitable discussion should be provided. At no period in the gas industry in the North has this oft repeated statement been so well timed.

To mention the epoch making work of Mr. Foulis at Provan, and of Mr. Herring at Granton, is at once sufficient to inspire men of less skill to be improving their knowledge and engineers holding positions of less importance to review their methods. In the march of progress it is undoubtedly true that in his endeavors to keep in line with the excellent results obtainable in works of magnitude the provincial engineer is beset with difficulties peculiar to the conduct of business on a small scale. Any enterprise upon which he embarks is more hazardous than in the case of a large establishment, where there is greater facility for experimental work, a larger field for the application of new schemes, and practically unlimited resources in the event of partial or complete failure.

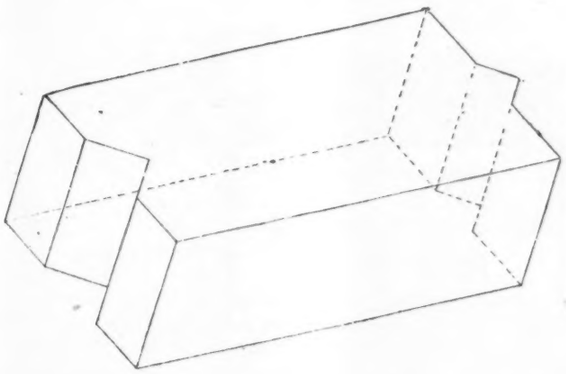
The primary object of the gas department at present is the economical production of gas suitable to serve efficiently the various purposes to which the commodity is applied. The first step towards success in this direction is sound retort house practice. No gas undertaking however small (provided regular work is practicable) can afford to have comparatively second rate carbonizing results. The importance of this is evident from the amount of attention which has been bestowed upon the subject recently by gas administrators in high places, and by engineers whose judgment in such matters we are bound to respect.

For some time past the engineers of large undertakings have been more particularly engaged in determining the relative effect of various systems of work upon the wages bill than in discussing the simple question of heating retorts.

No controversy has so fascinated the profession as the discussion in the technical press upon machine charged horizontal retorts *versus* inclined retorts, centralized hoppers *versus* continuous hoppers, and the value of the numerous ingenious accessories which have been devised and applied to simplify the workings of the various systems, in order to increase the revenue earning power of the capital employed and to reduce tear and wear charges and carbonizing wages, while securing the most efficient and uniform results possible. The comparative results of the working of these systems on a large scale, under conditions favorable to each, will be watched with the keenest interest.

It is not my purpose here to discuss the relative merits of inclined and horizontal retorts. The solution of this problem is in able hands. I propose rather to discuss the question of carbonization in so far as it concerns the general body of the members of this Association. It is acknowledged that for the economical production of gas the temperature of the retort must be maintained at 2,000° F., and that to accomplish this all that is required is a gas producer constructed to contain a sufficient quantity of coke disposed in such a manner as to provide a regular supply of carbon monoxide gas of good quality to the setting. It has not been so generally admitted that the gas so generated should be equally distributed throughout the length of the setting before secondary combustion takes place, but it is established that a supply of heated secondary air is necessary, and that the heated air should approach the gas at the point where the latter enters the setting proper; and, further, in order to obtain satisfactory results from the high temperature which ensues upon secondary combustion, the retorts must be so set and arranged as to provide for an equal distribution of heat throughout the oven, the temperature being controlled by a careful adjustment of the primary and secondary air inlets and damper openings, based upon simple tests of the waste gases.

Settings constructed upon these lines are productive of the most satisfactory results, provided always that the material and workmanship are of the best quality, and that the channels through which the secondary air passes to the combustion chamber are sufficiently tight to prevent "short circuiting" of the heated air into the waste gas flues. No amount of thought and attention bestowed upon the perfecting of the design and arrangement generally will compensate for a defect in the air passages. Various expedients have been tried, from time to time, to remedy this great evil, but in many cases with disappointing results, due not so much to any weakness in the design itself as the difficulties experienced in getting the work put together in such a manner as to secure a tight joint to begin with, and to provide against the risk of fracture or displacement in working. I am of opinion that the simple ap-



Nine inches by 3 inches by 4½ inches Fireclay Brick showing Feather and Groove.

plication of the principles of recuperation gives the best average results, offers the greatest security for the capital employed, and is most profitable in the end. I have found that well shaped bricks properly laid by skilled workmen make the most secure division walls between the secondary air and waste gas flues. To reduce the risk of short circuiting I employ the triangular joint "A," in the vertical joints of flue walls and in the horizontal joints of flue covers.

In stage floor benches (see Fig. 1) the flues are carried under each other and sandwiched vertically between the waste gases and the producer walls in the usual manner, but in small settings constructed on the semi-stage or shallow chamber plan, the secondary air flues are constructed on the horizontal line, as shown (see Fig. 2), sandwiched between the waste gas flues. In the latter arrangement (which has the advantage of thoroughly heating the air within a small space) the cost of excavation and underbuilding is reduced to a minimum, and all the flues and dampers are accessible from the ground floor line. Short circuiting if it does ensue, will occur between air and air, not between air and gas. The advantages of the regenerative system are admitted. Cases of failure have been recorded, arising from various causes, but directly traceable, in some instances, to the multiplication of passages of restricted area, requiring excessive chimney draught and resulting in the undue formation of clinker and aggravation of the evil of short circuiting. But such cases are exceptional.

The advent of the regenerative system of heating retorts marked the beginning of better conditions of labor for the stoker, and more uniform and economical results in the retort house. The general prosperity of the gas business has been shared by the workmen, and rightly so, in increased wages and a shorter day of labor. Carbonizing costs are consequently high, and attention is largely centered upon ways and means of reducing this item. In up-to-date works of sufficient size simple hand labor has been supplanted by mechanical appliances, in whole or in part, by machines worked by hand labor, or by machines merely directed by skilled hands. The 10-ton coal wagon is caught on the hydraulic ram or on the end of the cable from the warping drum of a steam winch, and the contents are deposited in the store, or delivered to the coal breaker or elevator boot direct, or through feeding hoppers, as circumstances permit. In well arranged works a 24 hours' supply of coal is elevated within an "8 hours' turn" to the overhead bins, to supply the machines by gravitation as required. To complete the mechanical equipment, hot coke conveyors, elevators, screening and sorting plant, and coke storage hoppers over railway sidings have been more recently applied, by means of which the market for coke has been materially improved, and the arduous and unhealthy task of wheeling and quenching hot coke is entirely superseded.

Such arrangements may fitly be described as automatic in their action; yet those of us who have had years of experience of hand labor as we find it practiced in Scotland, may be slow to convince that the mechanical stoker is "a machine so constructed as to imitate the actions of men," and if mechanical stoking is not applied in small works in Scotland to the same extent as we find it south of the Tweed, the explanation may be that our stokers, like Sir George Livesey's "man with a shovel and a barrow," take a lot of beating. There can be no question, however, that our boasted record hand labor results have been obtained to a large extent at the expense of the working man. It has been urged that gas stokers, taken as a class, are the healthiest set of men in the community. While admitting that the work is by no means unhealthy —far from it—I am prepared to say that gas stoking never made a man healthy, and that unless he had been constitutionally strong to begin with he could not have endured the strain.

Judged from a purely commercial standpoint, if 24 good men can do

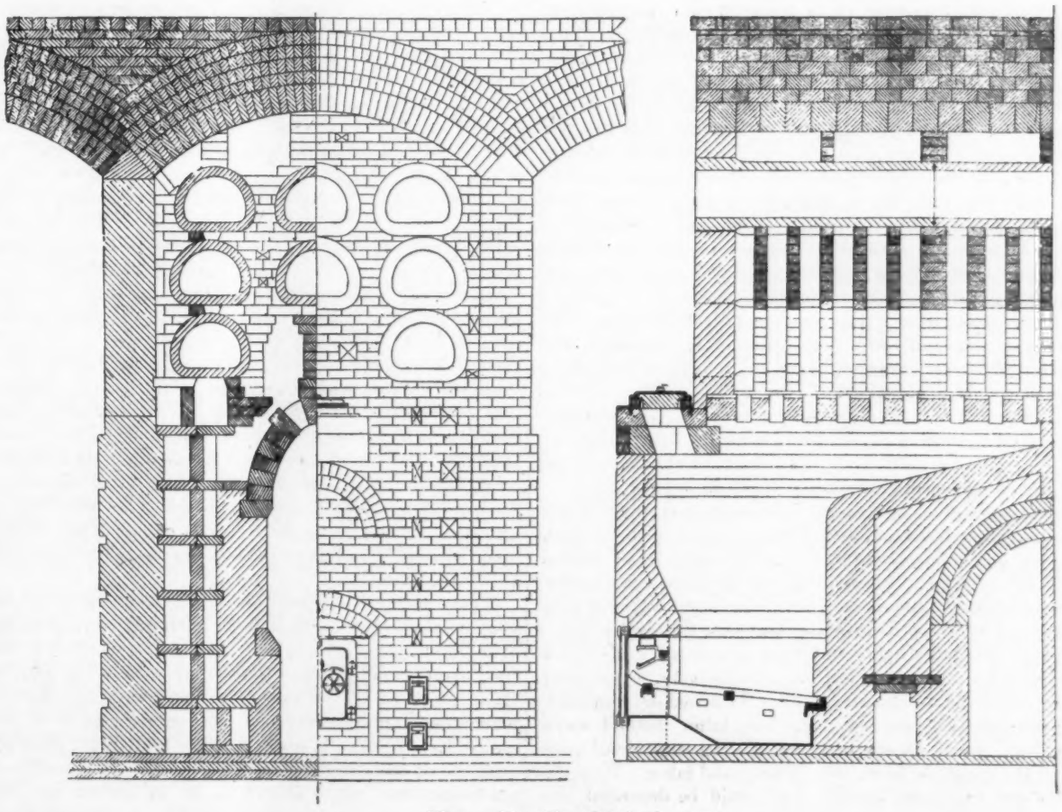


Fig. .—Stage Floor Bench.

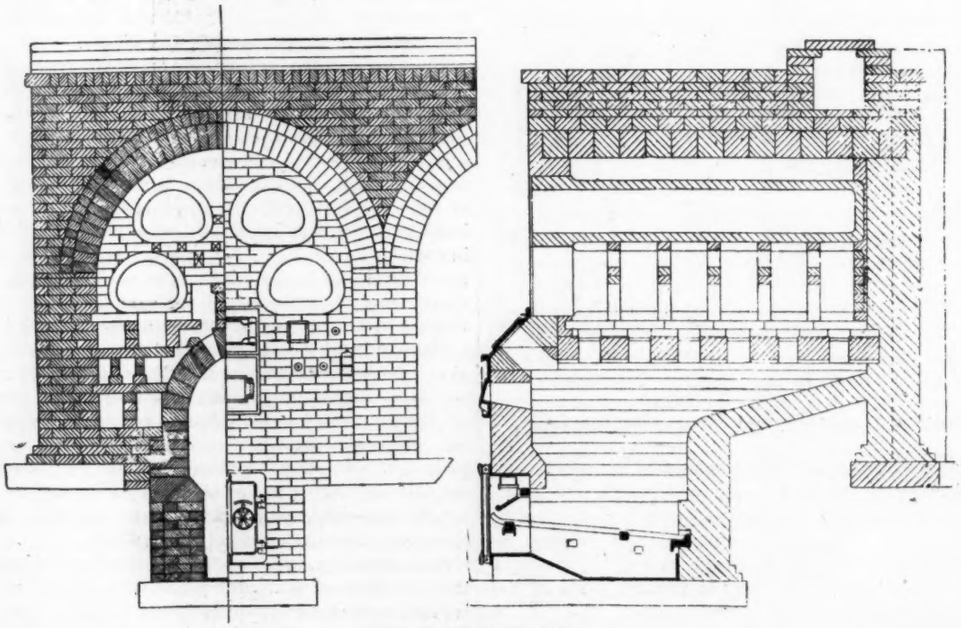


Fig. 2.—Semi-Stage Bench.

a certain amount of work by simple hand labor, 13 men selected from this number, with the aid of coal breaking and elevating plant and manual stoking machines, will accomplish the task, including hot coke wheeling, with less expenditure of energy, and will return to work after a 16 hours' rest more fit than the hand stoker possibly can be. A further advantage accruing from the use of machinery is that the quality of the work does not vary with the individual skill of the men employed, as is the case with shovel charging. One intelligent and reliable leading stoker on each set of machines is able to control the quality of the work performed by his squad. One man is responsible for the effective carbonization of the coal used, and the results obtained, so far as they are affected by labor, are more uniform than is the case with shovel charging. In the event of sickness, moreover, the place of the absentee is more easily filled. The balance off efficiency is, therefore, on the side of the machinery. But what of the ultimate cost? The guiding principle in our consideration of any scheme is the cost per 1,000 cubic feet of gas of a given illuminating power. The value of any system of work, taken upon a commercial basis, must be measured by its influence upon the cost of material and labor per 1,000 cubic feet, after meeting repair and maintenance charges, renewals, interest, and redemption of the initial expenditure on the plant employed.

The success or failure of an installation depends not, as might at first sight appear, so much upon the amount of money spent upon the plant as upon its design and arrangement to suit the peculiar set of circumstances which have to be met. Mechanical coal breakers and elevators are necessarily centralized appliances. In well arranged works of large proportions the coal is dropped upon the breakers, through which it passes to elevators delivering upon conveyors, which carry the coal to centralized hoppers for immediate use; or, alternatively, to the store, from which the coal is again elevated to the centralized or continuous overhead hoppers, as the case may be. The latter method means "double handling," which, in small works, dealing with small quantities, would, in the result, be more costly than hand labor. If regular supplies of dry and otherwise suitable coal could be depended upon every day in the year the problem would be solved. But deliveries equal to the day's demand must be maintained in winter, and any portion of this supply which is set aside as too wet for immediate use will, if it is moved to the boot of the elevator again by hand labor, result in largely increased carbonizing costs for the time being; to avoid which the risk of working wet coal is not infrequently taken, and a more serious loss incurred in reduced yield per ton and in illuminating value.

Such difficulties are, it is true, peculiar to small undertakings, in which the saving to be effected by a complete equipment of machinery would not be sufficient to balance the increased fixed charges incurred. To meet the case, the writer has elaborated a scheme to work in conjunction with and between the high level and low level railways in the Friarton works, Perth, by means of which the difficulties referred to will be modified to some extent, if not entirely removed. Taking advantage of the fall of 15 feet from the high level railway to the foot of the coal store, the scheme provides for the construction of a hopper having a capacity of 175 tons of coal (equal to 2 days' maximum demand), constructed immediately underneath the railway and extending to a depth of 8 feet under the coal store floor, to which point the floor of the coal store will be sloped at a suitable angle in the vicinity of the hopper, so that dry coal may be drawn from the store by gravitation, in the event of the daily deliveries being wet. The elevator will be fixed in front of the feeder at the bottom of the hopper, from which point the coal will raised to overhead storage hoppers having a capacity equal to fully 24 hours' maximum demand.

The scheme further provides for the conveying of hot coke direct to screens, sorting plant and overhead storage hoppers having a capacity equal to about three days' production of coke, nuts and breeze. Provision is also made for storing coke in the yard direct from the hot coke conveyor, in a position convenient to the gravity bucket elevators, so that stock may be elevated without having recourse to hand labor. The coal handling section of this plant is distinctly a profitable labor saving appliance, and in the coke handling section, while securing improved conditions of labor, it provides, in the screening and sorting of coke for the market, a degree of efficiency which is not attainable by hand labor, unless at considerable expense. As a matter of fact, this section of the plant will effect a saving sufficient to redeem the total initial outlay in five or six years.

It may be argued—possibly wi h a certain amount of reason—that in some cases mechanical equipment has not shown a great margin of profit over well directed hand labor. This will depend, to a considerable extent, upon the efficiency of the machinery and the quality of the hand labor supplanted, and upon whether, with the introduction of the machines, circumstances of a disadvantageous or of a compensating nature have arisen. It is not sufficient to simply "put through" a given quantity of coal; the general efficiency of the retort house work must not be sacrificed to any branch of it. A careful analysis of accounts may show that in some cases where the carbonizing wages are low the yield of gas per ton of coal carbonized is correspondingly low, and in other instances the carbonizing costs may be higher and the cost of coal relatively high, yet the ultimate cost per 1,000 cubic feet of gas into the holder may compare favorably with those cases where the labor charges per ton of coal are less. For example:

| Cost of Coal and Carriage per Ton. | | Carbonizing Wages per Ton. | | Total. | | Yield of Gas per Ton. Cubic Feet. | | Carbonizing Wages per 1,000 Cubic Feet Made. |
|---|---|---|---|---|---|---|---|---|
| $3.00 | + | 37 cents | = | $3.37 | ÷ | 9,000 | = | 37 cents |
| 3.25 | + | 50 cents | = | $3.75 | ÷ | 10,000 | = | 37 cents |

While wages in the one case are 4 cents per 1,000 cubic feet, in the other case they are 4.8 cents, yet the higher yield per ton in the latter case, although purchased at a higher cost for coal and wages, is suffi-

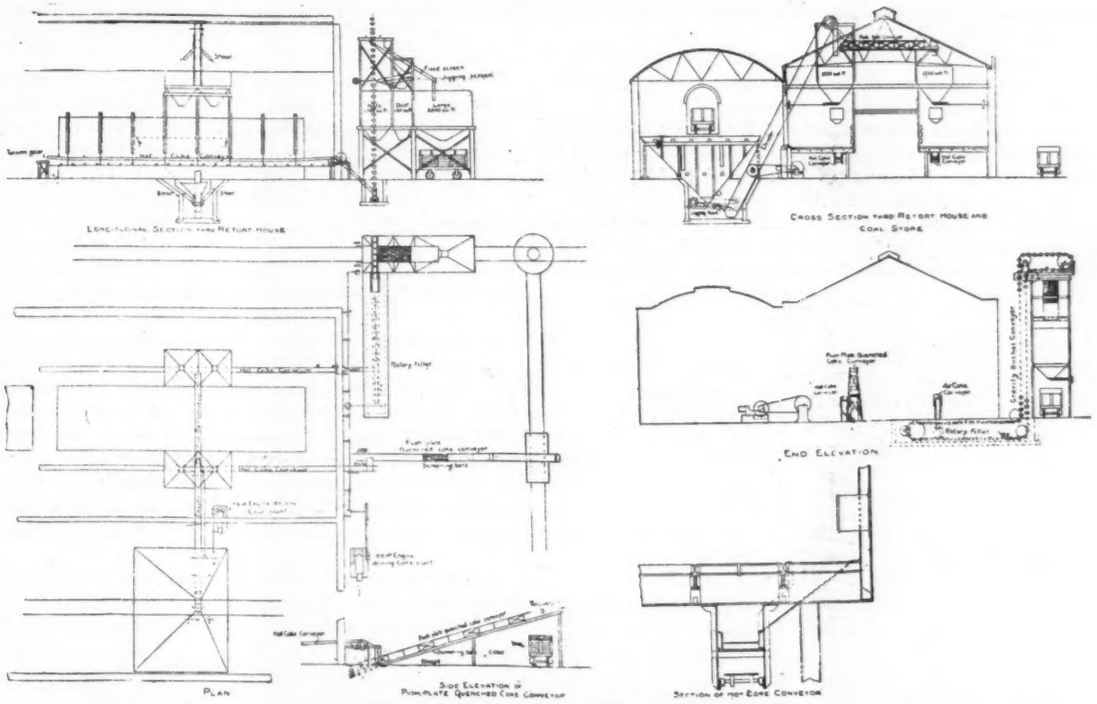



**Fig. 3.**—Perth Gas Works—Proposed Coal and Coke Handling Plant.

cient to redeem the cost of the gas at the holder. It may be urged that for purely "carbonizing" purposes the difference in volume might be compensated for by the value of the residuals obtained; but my point is that if the producing power of the retort is impaired by the peculiar method of handling the materials, the loss is absolute so far as the efficiency of the plant is concerned, and the evil must be struck at at its root.

The complaint that with machine broken Scotch common coal distillation does not proceed so rapidly as with careful hammer broken splints is not without foundation. In the case of hammer broken splints the resulting dross is suspended in thin layers upon the large pieces in the retort, and no inconvenienc is experienced. With machine broken splints, on the other hand, although the coal is more uniform in size, no large pieces remain as carriers for the "small," and nothing short of a sharp heat will effect distillation within the time limit to which we have been accustomed. In my own case I find it more profitable to get the coal broken at the pit and delivered in the form of clean nuts. The quality is not inferior, the price is less, and the results are better than with machine broken splints. The nuts are dropped to the boot of the elevator direct, through a by-pass, and the breaker is reserved for cannel, which it reduces to the uniform size of a hen's egg without making an undue amount of "small."

With 112 retorts at work in December last, carbonizing wages, with the aid of West's manual charging and drawing machines served by one coal breaker and elevator, but without coke handling plant, amounted to 35 cents per ton of coal carbonized; and in November, with 96 retorts in action, the cost per ton of coal carbonized was 37 cents. The average carbonizing wages over the year amounted to 46 cents per ton and 4.4 cents per 1,000 cubic feet of gas made, including discharging of coal into store, coal trimming, charging and drawing, coke wheeling and trimming. These figures are not low, but they may be regarded as moderate, keeping in view the fact that stokers' wages are, respectively, 16.14 cents per hour and 15.06 cents per hour, according to grade, and that for a large part of the year the number of retorts in action is not sufficient to keep a set of men fully employed.

In conclusion, I am persuaded that in the development of the retort house we have ample scope for the exercise of our surplus energy, and that for the effective carbonization of coal and the economical production of gas a well ventilated retort house, with retort settings constructed on the most practical scientific principles, is an absolute necessity, and that works not so equipped are severely handicapped. Without such a retort house the profit earning power of the concern is not sufficient to yield an adequate return upon the capital employed, as the result of which the selling price is high, while the dividend is low and the plant is less or more starved. A year or two of high prices for coal and low returns from residuals and the resources of the undertaking are exhausted, in consequence of which the development of business is hampered and enterprise is choked. In small works the regenerative setting is, comparatively, a labor saving appliance; and in every retort house where machinery can be employed to advantage its introduction will not only result in largely increased profits and better conditions of labor, but also in a higher state of efficiency in the gas works generally.

## Note on Some Experiments with a New Form of Pressure Regulator.

[By William Kendrick Hatt, C.E., Ph.D., Professor of Applied Mechanics, Purdue University.]

*General.*—The writer here records some experiments which were made under his direction in the engineering laboratory of Purdue University, on a new apparatus by Mr. Will Hull, of the Class of 1901, who developed the details of the apparatus at the suggestion of Mr. J. T. Wilkin, Engineer for the Connersville Blower Company, Connersville, Ind.

The apparatus (Fig. 1) consists essentially of an expanding nozzle and a flat circular disk, against which the jet from the nozzle is directed, the disk being inclosed in a suitable chamber. The action is similar to that of the well-known ball nozzle, and the disk replaces the ball. In case of the ball nozzle the back pressure forcing the ball against the jet is the pressure of the atmosphere. In the apparatus the disk is inclosed in a chamber, and the back pressure is the pressure of the water in the chamber. This pressure is greater than that in the rapidly moving sheet of water on the upstream face of the disk, so that the disk moves toward the nozzle until equilibrium is established. The disk thus automatically throttles the upstream.

When this apparatus is inserted in a pipe line the pressure of the down stream face of the disk is preserved fairly constant (within the limits of the experiments and for certain range of pressure in case of the apparatus used), while the upstream pressure varies within wide limits. The principle of the apparatus will have an application whenever it is desired to deliver water at a constant pressure to a machine from a source of supply subject to fluctuations of pressure. Whether a design of disk and nozzle could be reached which would regulate pressure in case of air or steam is not determined.

The experiments were initiated with the desire to obtain information which would serve as a basis for proportioning this apparatus to serve various conditions of pressure and delivery. The experiments were interrupted before that point was reached. The results obtained with the apparatus are generally interesting, and it seems worth while to record them.

Mr. Hull used various combinations of disk and nozzle until he found

the proper combination which would regulate the pressure used in case of the apparatus available.

In brief, he found that a nozzle of form specified in Fig. 2 (called a ¼-inch nozzle), in combination with a 2-inch flat disk, would regulate the pressure in a ½-inch pipe to the following extent:

The pressure on the down stream section of the pipe was preserved constant at 2½ pounds per square inch by the action of the disk while the pressure of the upstream section varied between 10 to 40 pounds per square inch by gauge (as shown on Fig. 4.)

*Appatatus.*—Fig. 1 shows the construction of the apparatus with nozzle, disk, chamber and spider for supporting the disk. The fitting of the apparatus for experimental work is shown in Fig. 3. The two gauges

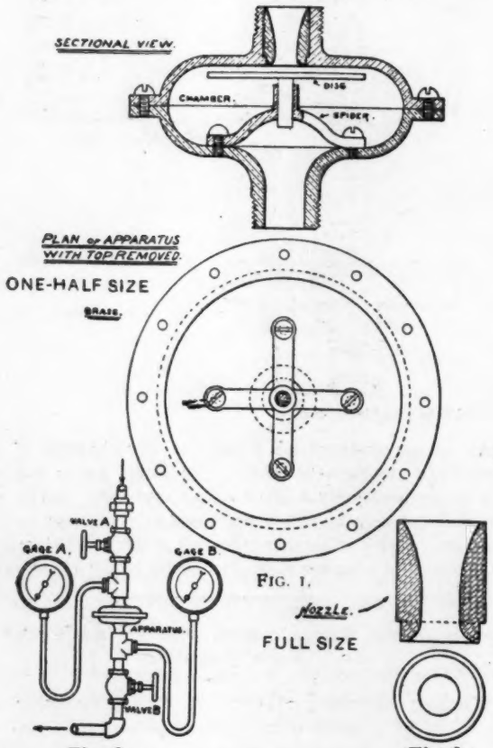



FIG. 1.

Fig. 3. Fig 2.

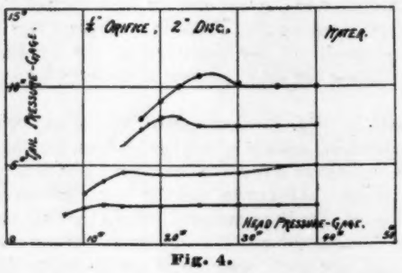



Fig. 4.

for measuring the pressure were placed as close as possible to the chamber containing the disk. The fittings were made with great care. The valves shown were for controlling the pressures used in experimentation.

*Method of Experiment.*—The apparatus was attached to the standpipe of the hydraulic laboratory, the pressure in which was controlled by a steam pump. Starting with a given standpipe pressure, say 40 pounds by gauge, the water was allowed to flow through the apparatus, being throttled by the lower valve to indicate a down stream pressure of, say, 2½ pounds per square inch on the lower gauge. This down stream pressure was allowed to remain fixed during the test, the lower valve not being disturbed. The upstream pressure was varied by use of the upper valve, throttling the upstream section. In this way upstream pressures of from 40 pounds per square inch down, by steps of 5 pounds per square inch, to the lower limit were effected. The apparatus discharged into a weighing tank and the discharge was weighed. The temperature of the water was taken every minute, because this temperature varied greatly throughout the tests, due to the fact that the standpipe tank was connected to the condenser of a Corliss engine. With respect to the effect of temperature on the results, it may be said that when the temperature of the discharge rose above the 100° F. the tail pressure gauge showed a very unsteady pressure, the needle vibrating with a range of as much as one-half pound.

The disk was, no doubt, at this time subject to vibrations, which, when the temperature of the water rose to 110° F., were of such frequency as to cause a musical note. Under the latter condition the needle was too sluggish to respond and remained at a fixed position. The movement is probably connected with alternate periods of vaporization and condensation of the water on the upper side of the disk.

*Results.*—The following combinations of nozzle and disk were used: ½-inch nozzle, 1-inch disk; ½-inch nozzle, 1½-inch disk; ½-inch nozzle, 2-inch disk; $\frac{3}{16}$-inch nozzle, 1-inch disk; $\frac{3}{16}$-inch nozzle, 1½-inch disk; $\frac{3}{16}$-inch nozzle, 2-inch disk; ¼-inch nozzle, 1-inch disk; ¼-inch nozzle, 1½-inch disk; ¼-inch nozzle, 2-inch disk.

Of these, the ¼-inch nozzle gave successful results; the ¼-inch nozzle with the 2-inch disk gave the best results. These are shown in Fig. 4. In working the head pressure down toward the tail pressure the former would approach a critical point at which the difference of pressure became so slight that the regulating effect ceased and both head and tail gauges suddenly moved to the same reading. The disk at this period, no doubt, dropped away from the jet. That is, a certain difference of pressures is needed to enable the apparatus to work. This difference of pressure became greater as the tail pressure was increased, as is shown in Fig. 4.

In experiments with the other orifices mentioned, the lines shown in Fig. 4 became straight lines inclined to the horizontal. The hump in Fig. 4 was characterized by an unsteady head pressure.

WATER.

*Quarter-Inch Orifice.* *Two-Inch Disk.*

| Gauge Pressure. | | Discharge per Min Cu. Ft. | Temp. of Water. Deg. F. | Gauge Fressure. | | Discharge per Min. Cu. Ft. | Temp. of Water. Deg. F. |
|---|---|---|---|---|---|---|---|
| Head. Pounds. | Tail. Pounds. | | | Head. Pounds. | Tail. Pounds. | | |
| 40.0 | 2.5 | 0.301 | 105 | 40.0 | 7.5 | 0.334 | 88 |
| 35.0 | 2.5 | 0.304 | 105 | 35.0 | 7.4 | 0.337 | 92 |
| 30.0 | 2.5 | 0.304 | 108 | 30.0 | 7.5 | 0.342 | 93 |
| 25.0 | 2 5 | 0.304 | 109 | 25.0 | 7.5 | 0.342 | 93 |
| 20.0 | 2.4 | 0.300 | 112 | 22.5 | 8.2 | 0.342 | 95 |
| 15.0 | 2.4 | 0.300 | 112 | 20 0 | 8.0 | 0 350 | 96 |
| 12.5 | 2.5 | 0.304 | 111 | 17.5 | 7.25 | 0.323 | 95 |
| 10.0 | 2.3 | 0.282 | 106 | 15.0 | 6.2 | 0.314 | 94 |
| 7.5 | 1.9 | 0.267 | 112 | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 40.0 | 5.0 | 0.330 | 95 | 40.0 | 10.0 | 0.377 | 82 |
| 35.0 | 4.8 | 0.322 | 100 | 35 0 | 10.0 | 0.385 | 81 |
| 30.0 | 4.5 | 0.315 | 99 | 30.0 | 10 2 | 0.388 | 80 |
| 25.0 | 4.4 | 0.306 | 97 | 25.0 | 10.7 | 0.388 | 78 |
| 20.0 | 4.4 | 0.306 | 100 | 22.5 | 10.0 | 0.385 | 78 |
| 17.5 | 4.5 | 0.315 | 105 | 20.0 | 9.0 | 0.361 | 78 |
| 15.0 | 4.5 | 0.315 | 104 | 17.5 | 8.0 | 0 336 | 78 |
| 12.5 | 4.0 | 0.302 | 105 | ..... | ..... | ..... | ..... |
| 10.0 | 3.2 | 0.270 | 108 | ..... | ..... | ..... | ..... |

Fig. 5.

One disk was beveled so as to give a constant area of passage way to the expanding ring of water; that is, it was dished, with the deepest part next to the nozzle. This disk preserved a constant difference of pressure between the head and tail pressures.

Some experiments were carried on with air as the fluid passing through the pipes. With the nozzle and disks used there appeared to be no governing effects in case of these air pressures.

In general, it may be said that the shape of the nozzle has most to do with the action observed. A number of nozzles of different form were used; those most nearly like that shown on Fig. 2 gave the best governing effect.

The size of the disk affects the results obtained with any given nozzle. The 2-inch disk gave better results than the 1-inch or the 1½-inch disk.

The action desired could be obtained with water at a temperature of 75° F. as well as at the higher temperatures.

A very pretty cylindrical sheet of water could be obtained by removing the lower part of the casing. The disk acted like the well-known ball nozzle. Under these conditions, with a head pressure of 40 pounds and a nozzle velocity (as figured from the discharge) of 14.6 feet per second, it was found necessary to exert a force of 9 pounds to pull the disk from the jet.

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THE Frenchtown (N. J.) Gas Company has filed articles of dissolution. It never was a going concern.

## Improvement in Electric Transmission by Wires.

By Mr. Chas. E. Frits, in *Elec. World.*

The writer has just had issued to him letters patent on a method of suppressing the inductive resistances which are usually encountered in telegraph and telephone lines and cables, particularly those of any considerable length, and as the subject is one of considerable importance at the present time, an account of the principles involved in the system may be of some interest.

These resistances are mainly static charge and retardation in the case of telegraphic and like currents, and self induction in the line in the case of alternating and telephonic currents. The troubles caused by them and the advantages which would result from their suppression are familiar to every engineer and practical electrician.

Although their suppression has hitherto been considered impossible, the method is simple and easy, and is equally applicable for removing them from existing lines, and for preventing them when constructing new lines; and in either case the expense is very small. The same general method is employed for suppressing both retardation and self induction in the line. For illustration, the method of dealing with an existing line to remove the retardation will be described.

It may first be briefly stated as follows: The continuity of the line or circuit is broken up by dividing it into disconnected sections or parts. These sections are made of certain lengths, depending on the conditions in each case. The sections are then connected in series through suitable inductive devices, such as condensers or inductance coils, thus forming a virtually discontinuous line, in which the electrical impulses are transmitted over the junctions by induction and over the separate sections by conduction, the final result being the same as with the usual continuous conductors, *i. e.*, the receiving apparatus reproduces the signals or impulses sent forth by the transmitter.

By breaking up the continuity of the line, cumulation of the retardation is prevented. As is well known the retardation increases as the square of the length of the line. A line or cable 1,000 miles in length will have a million times as much retardation as a line 1 mile long. The reverse is also true, and the retardation decreases as the square of the reduction in length, so that we can make the retardation in a conductor as small as we wish by reducing its length. By dividing it into sections so short that the retardation in each section is practically *nil*, and forming a line with such sections, the whole line will also be free from retardation, no matter how long it is, provided we connect the sections by devices which will transmit the signals or impulses, but on the other hand will not permit the cumulation effect in the composite line.

That can be accomplished by electrical condensers or equivalent devices, among which may be mentioned self inductive coils. When condensers are used, the ends of the adjacent sections are properly connected to the opposite armatures of the condensers. A section thus freed from retardation is called a "non-inductive" section, and a line composed of such sections arranged in series according to the patented system, is a non-inductive line or cable, meaning one which is practically free from inductive resistances, or sufficiently so as to answer the purpose in the given conditions.

The line (that is to say, the portion which is between the terminals which are operating at the time) is connected to earth through the station apparatus at each end, but it has no earth connections between those terminals, no matter how many stations it passes through or how many lines are connected in series. All intermediate calling, relaying, receiving and other instruments are inserted in the line without grounds, unless the grounded station is to become a terminal.

Owing to the absence of inductive resistances in the conductor, the possible length of line which can be operated by this system is many times greater than by the present systems. It can be relayed, however, and the new line may be organized either on this system or on the present system, as preferred. By adhering to this system it can be relayed as often as desired, and messages can be automatically repeated to any required distance without interference by the usual inductive difficulties.

This system has been practically demonstrated. The following is believed to be a correct explanation of the theory of its operation. The first effect of the transmitter is to produce a wave or impulse of *electric induction*, or inductive influence, which travels over the whole line instantaneously (at the rate of 186,000 miles per second) and polarizes it, giving the condensers what may be called *kinetic potentials—i. e.*, having the power to draw currents in until fully charged, thus making them actual potentials, corresponding to the signals or impulses sent out; but, as yet, no current passes over the line. The actual flow of currents over the several sections to their respective condensers comes later, in consequence of the polarization of the line and the difference of potential in the condensers, before referred to; and this flow continues till the condensers are charged up to that *actual potential*. That flow of current is not instantaneous, but requires time.

The time depends on the ohmic resistance of the section (supposing that the inductive resistances have been removed) and on the electrostatic capacities of the condensers. The less the resistance, the larger the current flow; and the greater the capacities of the condensers, the longer the time required to charge them up to the proper potential. As all of the condensers were polarized at the first instant, these currents flow into all of them *simultaneously*, not consecutively, and the time required to charge all of them is the same as for one.

For the same reason *no cumulation effect is possible*, and the retardation on the whole line is numerically equal to that of a single section. This last statement, about the value of the line retardation, has not been verified by measurement, but it is believed to be correct.

It is not always necessary to remove the retardation completely, as in some cases a moderate amount of inductive resistance would be of small practical consequence. The theoretically correct amount can be ascertained by calculation, and the required approximation to perfection can be found by experiment. The amount so found will be the standard or proper inductive resistance which may be allowed in the sections of that line or circuit. The inductive resistance must not exceed that amount in any section; but it may be less than that in one or more sections, without injuring the performance of the line.

In the same way, the ohmic resistance in any one section of the line must not exceed the standard, which is normally the ohmic resistance of the section containing the transmitting apparatus, and which should properly control the action of the entire line. The frequency and rate of charge and discharge of the transmitting condenser (the one to which the generator is connected) compel a like action in all other condensers of the line. The condensers do not charge and discharge suddenly, as some might suppose, but precisely in accordance with the form of the wave or impulse given out by the transmitter. The ohmic and inductive resistances of that section, are therefore the standard or maximum resistances allowable in the sections of that line.

The electr. static capacities of the condensers must be sufficient to become charged to the desired potential by the current flowing through the given resistances for the time occupied by the longest signal, impulse or current wave which is to be transmitted. The electromotive force of the generator must be high enough to send through the given resistances a current large enough to charge the condensers as described —all of which will be readily understood by those familiar with the properties of condensers.

As all the sections must conform to these limitations, it is evident that the greater the inductive resistances are in any particular line or cable, in the given conditions, the shorter the sections of that line must be cut when dividing it up, in order to conform to the principles of this system. No matter how great the retardation or the self-induction may be, it can be entirely removed by simply making the sections short enough. In case different lines are connected in series, as, for instance, a submarine cable in series with a pole line, the cable sections would have to be much shorter than those of the pole wire, although both are in the same line; and if the line is organized according to the principles of this system, it will operate satisfactorily.

It is worthy of note that this method is not limited to extended conductors only, but is equally applicable to long conductors in the form of coils or solenoids, etc. When the conductor is properly divided into sections connected by condensers or equivalent devices, the retardation and self-induction are suppressed, without interfering with the dynamic induction of each turn upon the others. The legitimate and proper action of the coil is thus greatly increased and improved, by the removal of the obstruction previously caused by the inductive resistances. This will be specially useful in the long secondaries of induction coils, by winding the coil in sections and connecting their terminals through suitable condensers. A coil is to be treated as a part of the line or circuit which contains it, and the sections of the coil must come within the same section standards or limits as the other sections of the line.

The foregoing is the normal arrangement of the line for alternating, telephonic, undulatory and similar currents; but with intermittent, interrupted and like currents, which terminate abruptly, such as those commonly used in telegraphy, there would be a discharge or return current flowing back over the sections at the termination of each signal or impulse, like the currents which produce the false signals or "kicks" on the ordinary telegraph lines. To prevent this in cases where such return current would be objectionable, a strongly self-inductive coil

(or the equivalent of that) is arranged in shunt around the condensers.

When the current or impulse arrives at each condenser the counter-electromotive force generated by the coil prevents its passage through the shunt until the condenser is charged up to the potential of the impulse. The potential of the impulse ceasing to rise, the counter-electromotive force of the coil disappears, and the opposite charges on the two sides of the condenser then flow freely through the shunt and coil and neutralize each other therein, thus preventing any return currents flowing back over the line, which is completely freed from all static charge immediately after the passage of each signal or impulse.

As all the condensers discharge at once, the line is freed from charge at as many points as there are condensers, all acting simultaneously, making the discharge of even the longest line very rapid and perfect. The inductance coil should be such as will stop the impulse as described, and its ohmic resistance should be as low as it can be and yet have the necessary inductive power. Of course, the inductance is not to be removed in the shunt coils, but magnified.

In this modified form (after the first instant, during which the condensers are charged) the current actually flows over the line from end to end, passing through the shunts around the several junction condensers. This arrangement has the further advantage that it permits the use of a very small condenser with a large current. The arriving impulse first charges up the condenser as before described and sends on an equivalent impulse by induction through it; then the remainder of the impulse flows through the shunt resistance as long as the signal continues. With this arrangement of the sectional line and small condensers, telegraphic messages can be sent over long ocean cables with ordinary Morse instruments as slowly or as rapidly as the operator can work the key. This alone would be a vast improvement, but it is one of the least advantages of this system. The accompanying illustration shows a line arranged as above described.

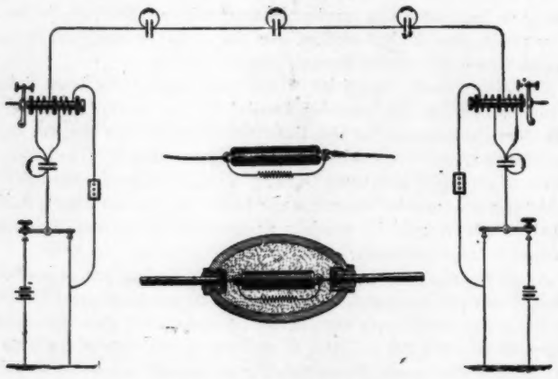

Diagram and Details of Circuit.

The shunted lines or cables can be used for all currents, but the line without shunts is for alternating, telephonic, undulatory and like currents, or for cases where return currents on the line are not objectionable.

As before stated, the same method is employed for removing or preventing self induction in the line as that described for retardation. The proper lengths and resistances for the line sections can be ascertained by calculations, or, if necessary, by direct experiment. The greater the frequency and the more abrupt the rise and fall of the current waves, the shorter the sections must be. The other details of the method have already been sufficiently described.

If line wires of iron or steel are used, the ohmic resistance should be low and the sections shortened to correspond with its self inductance, as compared with copper.

When inductance coils or other equivalents of condensers are used as the inductive connections, the foregoing explanations need no change, except the omission of the condensers.

The control of the entire line by the transmitting condenser, as before mentioned, will also result in largely freeing the line from the action of external inductive influences, such as earth currents, telephonic cross talk, and the like.

It will be observed that this method has nothing in common with the inventions of Professor Pupin for a similar purpose. He adjusts the resistances of the line in such manner as to cause it to respond to currents or impulses of certain periodicities. This method *removes* the inductive resistances entirely and leaves the line open for the unobstructed passage of currents having any periodicities that may be desired. In a case where his method would require eight divisions of the cable per mile, this system would make the sections from 40 to 50 miles in length, which shows a wide difference in the principles of the two methods. Moreover, this application for patent was filed more than 10 years before Professor Pupin began his researches.

Existing lines can easily be altered to this system by calculating the proper length of the sections and inserting the condensers or other connections at or near the proper points in the line. In land lines the ordinary ready made condensers are suitable and can generally be located and sheltered in some station or house near the proposed junctions.

For cables, the condensers (and the shunts, when used) can be inclosed in suitable water tight junction boxes, which are then laid with the cable. There are no moving parts, nor any adjustments required, after the parts are constructed and connected as described. In altering a cable already laid, junction boxes, with condensers, etc., are prepared beforehand. The cable is underrun at the proper points and brought to the surface, the junction boxes are connected in, sealed and wrapped, and the cable lowered to its former position. Drawings and descriptions are given in the patent.

This line can be worked simplex or duplex, and with a single wire or a complete wire circuit, as preferred. With suitable modifications and additions, it can also be quadruplexed. The patent shows the duplex and simplex arrangement. For telephony, the telegraphic instruments there shown are replaced by telephonic transmitting and receiving apparatus of any desired kind, with or without the usual induction coils.

But it is especially valuable for long distance telephony and telegraphy, and for very rapid telegraphic transmission, both automatic and synchronous. It not only admits of sending signals, impulses or waves having any desired frequency, but it actually operates better, the greater the frequency. This multiplies almost indefinitely the number of messages that can be sent over one line wire arranged on this system. The "frequency" mentioned refers to the number of the current alterations, waves or impulses—not to the etheric vibrations. It will, of course, be understood that this system is not designed for the transmission of unbroken and unvarying direct currents, but is for interrupted, alternating, undulatory, or other *varying* currents, which are subject to obstruction by inductive resistances.

When the conductor is thus freed from inductive resistances, it is reasonable to suppose that telephony will also be practicable over the longest ocean cables, and on underground and other lines through which now not a word can pass.

At first thought it appears strange to send impulses or currents over discontinuous lines or conductors, *i. e.*, without any electrical conductor connecting the operating stations. But, as a matter of fact (with the exception just noted), practically everything that can be done on a continuous line can be done *better* on a discontinuous one, and any ordinary continuous line will operate better when altered over to this system.

Another advantage is that this system is to a great extent untrammelled by the many limiting and interfering patents which hedge about the continuous conductor systems. It is not impossible that sectional may soon supersede continuous conductors, as largely as alternating have superseded direct currents—if not more so.

Considering the many advantages of this system and the consequences which must necessarily follow from the suppression of inductive resistances in electric lines and circuits, it would seem to be a very important practical improvement in electrical transmission by wires—almost a new art. It is useful for many purposes besides telegraphy and telephony, which cannot be explained at present.

## Roofing Tin.

The *Railway Review* notes that for some time past there have been frequent controversies in trade circles about the quality of terne plates (roofing tin). It is universally conceded that, all things considered, the thin sheets of iron and steel when well covered with the non-corrosive alloy of tin and lead are the most convenient and most serviceable form of roofing material. Terne plates are pliable and can be worked around sharp corners as well as on rounded or flat surfaces. The nature of the coating is such that the several plates can be seamed and soldered together into one large sheet of unbroken surface, which by means of the several seams is sufficiently flexible to allow for contraction in cold and expansion in hot weather. The rigidity and toughness of the steel, which forms the base of terne plates, make the latter unbreakable, and yet their weight is less; and being non-combustible affords better protection against fire than any other roofing material.

These and many other merits possessed by roofing tin are conceded by everybody, but the contention is that terne plates made in recent years do not possess the same lasting qualities which in former years made this class of roofing stand without a peer in the roofing business. The blame for the alleged deterioration is generally but erroneously placed on the fact that soft steel has been substituted for wrought iron.

Before the Bessemer and open hearth or Siemens-Martin steel processes were invented the iron base of the coated sheets (commonly called "black plates") was, like all other forms or shapes of wrought or forged iron, rolled from blooms, produced in the knobbling fire or puddling furnace, but now Bessemer and open hearth soft steel are being used almost exclusively.

It seems reasonable that our steel makers did not and could not know at once for a certainty what ingredients and qualities of raw materials were required for roofing tin purposes and they may have occasionally made a miss of it; but everybody who became acquainted with the new steel process saw at once that the latter afforded far better facilities for homogeneousness and uniformity of product than the old methods. As is nearly always the case, so it is here, when people receive an inferior quality of the new product they will make comparison with the best class of material that had been made in the old way, forgetting entirely how often they had to hear complaints of various defects, such as that sheets were blistered or so brittle that they could not stand plain seaming, etc., defects which have been almost entirely eliminated by the steel process.

The nature of soft steel is, of course, different from that of wrought iron, and it must be admitted that while the advantages possessed by the substitute outnumber by far the disadvantages, some of the latter were encountered at first and it took time and study to overcome them, but that has now been successfully and completely accomplished.

At the present time a number of the great steel works, having recognized the importance of the tin roofing trade, make soft steel bars for high grade roofing tin purposes a specialty. We find that the raw iron for these bars is carefully selected, analyzed and inspected. The melting and casting of the ingots are done in a manner which eliminates or rather brings to the surface of the molten metal all the impurities that may have been contained in the raw material, and these are removed before the metal sets. As a further safeguard the top of the ingot is cropped before it is rolled into the "tin bars,"[1] and thus there are absolutely no impurities left in the metal that could cause disintegration from inside to out. The iron in the steel tin bar, and consequently in the black plates, is purer than it could ever be in wrought iron.

Some people have argued that the purity of the steel is the very cause of its quicker oxidation, but however that may be as regards uncoated steel goods, pure iron will not rust if it is removed absolutely from contact with the atmosphere by a covering of such non-corrosive metals as tin and lead.

It would be a strange fact indeed if in spite of all the progress that has been achieved, and in spite of all the scientific researches, we would have to go back to old and obsolete methods in order to produce good roofing tin. We now have the evidence that the once existing difficulties have been overcome and that good roofing can be obtained by those who will go to the trouble and look for it.

A coating process which will assure a thorough amalgamation of the coating mixture with the body of the plates is most essential in the production of reliable roofing tin. A careful study has revealed the fact that inferior coating methods are to blame for the production of inferior roofing tin rather than the substitution of soft steel for wrought iron.

It was unfortunate that almost simultaneously with the introduction of Bessemer and open hearth steel a number of new coating processes were tried and introduced with the view of reducing the cost of production, but the reduction if effected was in most cases at the sacrifice of quality.

At present there are yet a number of coating processes in vogue, and users of roofing tin will do well if they post themselves on the merits of the same. The United States Navy Department, which is known to be most careful in its investigations and strict in its requirements, has adopted the following in its standing specification for roofing tin:

"All roofing tin to be made of best quality soft steel as a basis.

"Coating to be thoroughly amalgamated with the black plate by the palm oil process. This coating must be applied so that the sheets be evenly and equally coated on both sides and the coating equally over each sheet. After the plate has been cleansed in a weak acid solution it is to be thoroughly washed with water, after which nothing is to be brought in contact with the black plate but pure palm oil, pure new tin and pure new lead."

Many of the leading architects are adopting the same or nearly the same specification. The amalgamation of the coating metal with the body of the black plate by means of the palm oil process (often called the "MF" method) has stood the test of time and has been found to be the most reliable.

Among the new inventions which have been made in coating methods is one which possesses real and high merit. This new method is a finishing process through which the plates pass after they come in a hot state out of the tinning pots. The treatment which the plates receive effects an instantaneous setting of the hot fluid coating while they are lying in a horizontal position in a bath of oily substance, the temperature of which is below the fusion point of the coating alloy. In this position the coating metal cannot run and must set at once uniformly all over the sheet, and the coating will be evenly thick from end to end and from side to side.

The plates receive a smooth mottled surface, free from dirty grease, clean to handle, and when finised have in addition to the metal coating a cover of transparent paint that does not interfere with the soldering qualities of the plates, but acts as additional protection against atmospheric influences. This method, when applied to plates that have been coated by the "MF" process, is an absolute insurance against corrosion.

The advocates of the restoration of the old iron base roofing tin frequently fortify their arguments by pointing out roofs which, though covered with roofing tin 25, 30 or 40 years ago, are still intact. While such is a good argument in favor of tin roofing generally it does not furnish a comparison between the lasting qualities of iron base and steel base tin roofing, for the tin roofs which wore out during the same period are not here any more, and as no record has been kept of them no one can know the proportion between long lived and short lived iron base tin roofs, and therefore these arguments are somewhat in line "with the pies that mother used to bake." On the other hand, "MF" roofing tin has been made with soft steel as a basis since 1878, and there are many roofs covered early in the eighties that still exist in good condition.

If the users of roofing tin will go to the trouble of paying close attention to the material which is put on their houses and will specify brands that bear the stamps of and are guaranteed by the manufacturers, they will find that roofing tin can be obtained which is better and will last longer than any that was made in olden times, and they will also find that tin roofs are still the best house covering and being the best will be the cheapest in the long run.

1. A steel bar rolled for tin and terne plate purposes is, in mill practice, called a tin bar.

## Progress Made and the Present State of the Art In Improved Methods of Car Lighting.

[A paper read by MR. L. T. CANFIELD at the last Convention of the Master Car Builders' Association.]

Prof. George D. Sanderson, of the University of Minnesota, delivered an address before the St. Louis Railroad Club on March 8, 1901, and also has an article in the May *Forum* of the same year, in which he treats on this subject so thoroughly that I think all parties interested in car lighting should study both articles.

The first light applied to passenger cars was in 1825 by Thomas Dickson, a conductor on the Stockton & Darlington Railroad, in England, he furnishing penny candles at his own expense. Following this we have oil lamps, which you have all had more or less to do with, and know of the inconveniences of trying to light passenger equipment with them, a few of which are: Oily spots on the carpets, floors, and on passengers' clothing, dirty lamps, smoky headlinings, and the frequency with which lamps must be filled. The candle light having been abandoned entirely and the oil lamp fast becoming obsolete, I will drop these two from the discussion.

Next we have the gas lamp, of which a great deal can be said. I think we all hailed with delight the Pintsch light, it giving off a very good light and being considerably cleaner than anything we had had to do with up to the time of its introduction. At the present time there are about 100,000 cars and engines using Pintsch light throughout the United States and Europe.

The introduction of the Pintsch light advanced the efficiency of car lighting to such an extent that there is not the same chance for improvement over the Pintsch as there was between the oil lamp and the Pintsch. However, the desire of the successful railroad manager and owner to make their passenger cars as comfortable and pleasant as they possibly

can for their patrons, forces them to be on the lookout for any improvements that are not so marked.

During the last few years a new kind of gas has come into the field as a luminant—acetylene—which was discovered in 1836 by Edmund Davey, professor in chemistry at the Dublin University, and he said at that time, from the brilliancy with which it burns in contact with air, that it is admirably adapted for the purpose of artificial light, provided it can be produced at a cheap enough rate to warrant its use.

Acetylene gas gives a very bright light of pure white rays. It is the most diffusive light we have, and approaches the sunlight more nearly than any other light known. Cars equipped with it have burners that consume one-half cubic foot of gas per hour, and gives a light of 35-candle power, while the Pintsch gas uses a burner that consumes about 2 cubic feet of gas per hour, and gives a light of 25-candle power. We have several different systems of furnishing acetylene gas for car lighting, some of which generate the gas from a generator applied to each car; others have a generating plant similar to the Pintsch gas plants where the gas is generated and compressed to as high as 300 pounds pressure per square inch. A method of storing acetylene gas was discovered by two French inventors, who found that one volume of acetone under ordinary temperature and pressure dissolved 25 volumes of acetylene and under 12 atmospheres of pressure would dissolve 300 volumes of acetylene. Acetylene is very explosive under compression, and was prohibited in England under the Explosive Act of 1873, but under the provisions of said act, it being shown that reservoirs packed with porous brick, acetone and acetylene were not explosive or possessed of explosive properties, the Secretary of State exempted it from being deemed an explosive April 10, 1891.

In the reservoir for storing this gas the porous brick, or asbestos, which is sometimes used, is simply for the prevention of explosion. The acetone is for the storing of gas in large quantities in small space, and these two do not enter into the quality or efficiency of the light. The bricks are first made of a mixture of clay and powdered charcoal. The baking of them burns out the charcoal, leaving a porous brick, with which the storage reservoirs are packed. If these bricks were pressed solid, closing up the openings made by the burning out of the charcoal, the solid substance would take up 20 per cent. of the space within the reservoir. Forty-three per cent. of the reservoir would be filled with acetone, leaving 37 per cent. of the space for expansion. A reservoir 20 inches in diameter by 10 inches long filled as stated above, charged with acetylene gas at 165 pounds pressure per square inch was placed upon a car on the Delaware, Lackawanna & Western, having four lamps with three burners each and one lamp with one burner. This gas burned a total of 260 consecutive hours and was in service from March 4, 1902, to March 12 of the same year, without recharging. The fact of being able to run the car so long without recharging makes this a very desirable light.

The electric light, in my opinion is the most important of all. When the incandescent lamp reached a practical form in 1879, its advantages were immediately recognized and to-day there is an annual demand for 25,000,000 or more of these lights. The carbon filament in a vacuum maintained by an air-tight globe when heated by electricity gives a very bright incandescent light and thows off very little heat to the surrounding atmosphere. A more equal distribution of light can be obtained with the electric light than any of the others mentioned. It does not vitiate the air in the least and can be lighted without matches, by the turning of a key or switch. You can light or extinguish the same at will without danger. Entering a tunnel all lights can be turned on from one point in the car, or can be extinguished in the same manner on leaving the tunnel. There is no smoke or disagreeable odor, and when first applied the public took very kindly to it, that is, as long as it worked all right. In cases of wrecks there is no danger from fire, as is the case with all inflammable substances, and in my opinion the makers of electric lights for railroad cars should be encouraged by giving them an opportunity to develop their device. I do not think there is any system far enough advanced to warrant its general adoption at this time, but great strides have been made in the past three years, and if followed up carefully, I am satisfied that the cost of maintenance will be greatly lessened. The principal objections to lighting railway cars with electricity are its cost of installation and the cost of maintenance. There are, as you are aware, several systems of electric car lighting in this country, all of which have to a greater or less degree desirable features, also many undesirable ones.

The three most important commercially are the storage battery, the electric motor driven by a steam engine, generally placed in the baggage car at the head end of thr train, and the axle lighting device.

The first of these, while maintaining a steady light, that is, if provided with a sufficient capacity, is objectionable in its present form on account of its excessive weight, its limited reserve capacity for unexpected delays or accidents, the necessary large proportion of time the car is kept out of service for re charging, or the amount of labor required to charge the batteries, and the limiting of the movement of cars so equipped to special runs.

The second, or steam driven motor system, is also objectionable on account of the expense of operating same, which includes with the cost of the special engineer or electrician required, the cost of maintaining all necessary apparatus pertaining to the power plant, and the excessive vibrations felt throughout the train when the engine is running the dynamo; the vibrations of the voltage at the lamps by the variations of the steam supply to the engine from the boiler of the locomotive; the danger of fire on account of the high voltage; also the limiting of movement of cars so equipped to special runs which destroys the mobility of the railroad company's car equipment as a whole.

The third, or axle lighting system, which, in my mind, is the best system in use to-day on account of allowing of the free movement of cars, consists of a dynamo or generator driven by a pulley on the axle of the car and the storage battery working in combination with the dynamo, the dynamo charging the battery when the car is running and the lights not burning, and working in series with the same when all the lights are burning. This system may be divided into two classes, one of which uses the so-called automatic regulator for maintaining the output of the dynamo constant by varying the strength of the field coils, thus keeping the voltage of the machine the same as that required by the lamp; but this regulator is such a delicate machine that the rough usage to which it is subjected in railway service puts it out of order very frequently. Besides, as far as I can learn, there has not as yet been made a perfect automatic regulating device for governing the flow or intensity of an electric current, and while they may be called automatic, and probably are automatic for a short time, they cannot be relied on. The other design depends upon the slipping of the belt on the pulley for maintaining the voltage of the dynamo constant; and, as you all know, the varying changes of the atmospheric conditions will affect the belt, and at the best this is a very crude and unsatisfactory way of attaining the desired effect, it requiring constant attention as it is not automatic.

In operating the axle lighting system, it is necessary to handle same with a great deal of care. The batteries, for instance, must be charged immediately after they are set up, as the plates will rapidly deteriorate if they are left standing in the uncharged diluted sulphuric acid which is used. Again, you must not charge or discharge same too fast for fear of buckling the plates, and when a new battery is placed in service it is necessary to charge and discharge it several times. If the battery is overcharged, charged or discharged too fast, it has the effect of sulphating the plates, which increases the internal resistance of the battery and also uses up these plates, and destroys the battery much sooner than in ordinary use.

I will not attempt to give a detailed description or try to explain the actual working of the electrical apparatus of these two different systems, as it would take up too much time, and in a general way they resemble each other, but will point out a few of the faults, showing what we have to contend with in trying to keep the lights burning when required. The dynamo does not become operative until the train has reached a certain speed, about 12 miles per hour, called the critical speed. In suburban service, for instance, if from any cause the batteries are run down, that is, nearly all of the stored electricity in them is used, you will not get the benefit of the dynamo in recharging them or helping to supply the light until the critical speed is reached, and in many cases about or before the time this speed is attained it is necessary to slow down the train for the next stop. Therefore you are not generating any electricity, but your lights are burning all the time and using it continually from the storage battery, consequently you are going deeper and deeper into trouble, on account of the lights growing dimmer and sometimes going out when the train is standing still or is running below the critical speed.

At this time of the year we naturally have very little trouble, but in the winter time, when the days are short, and it is necessary to use the light for a longer period of time, it is different. On through service you will not, of course, have this particular trouble to contend with, but in the operating of this kind of light the belts occasionally jump off of the pulleys or break, the battery becomes defective, the regulators get out of order, the fuse burns out, there is a short circuit, a wire is broken, the armature burns out, the armature shaft breaks, the dynamo runs hot, the commutator is out of order, or something in the system gives out or goes wrong, and the lights become dim or go out altogether; then we are in trouble.

At the present stage of electric lighting in railway service it is absolutely necessary to have an auxiliary light at hand to fall back on. I am sure many of us who have had experience with this light would be perfectly satisfied to do away with it on account of the trouble it has caused; but this is an age of progress and there is no doubt but that there will continually be improvements made in electric car lighting. When it is so perfected that it will not require an expense greatly in excess of that necessary to maintain the gas lamp of to-day, I am sure it will come into general use.

One point I wish to call your attention to is the fact that the dynamo should be hung to the bottom of the car where it would receive the benefits of both elliptic and equalizer springs to relieve it of all the shocks possible. Another thing, a long belt is desirable in preference to a short one on account of allowing the dynamo to adjust itself to the lateral motion of the axle; but it is absolutely necessary to have the perfect belt cover so as to increase the life of the belt.

I will conclude by reading a statement comparing the cost to our company (Delaware, Lackawanna & Western Railroad) of each kind of light for one month:

*First-Class Cars.*

| Kind of Light. | No. of Lights. | Average Mileage. | Cost per Car. | Cost per Flame. | Kind of Service. |
|---|---|---|---|---|---|
| Oil .. ..... | 6 | 12,710 | $2.40 | $0.40 | Through. |
| Electric lights... | 17 | 2,092 | 8.81 | 0.52 | Suburban. |
| " .... | 36 | 12,710 | 37.31 | 1.04 | Through. |
| " .... | 25 | 1,560 | 7.57 | 0.30 | Suburban. |
| Pintsch gas..... | 20 | 12,710 | 5.73 | 0.27 | Through. |
| " ..... | 16 | 2,092 | 2.45 | 0.15 | Suburban. |

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Astoria (N. Y.) Light, Heat and Power Company, which is owned by the Consolidated Gas Company, of this city, has added materially to its real estate possessions through the purchase from the Woolsey estate of extensive tracts of land over and beneath water adjoining the plots heretofore owned by it.

A FRANCHISE for the operation of a gas works in South MacAlister, Ind. Ter., was granted to Mr. R. S. Kramer, July 28th. Later on it was assigned by him to Mr. J. A. Jones and associates. The present owners are contemplating the construction of a coal gas plant, from which it is proposed to supply South MacAlister and adjoining places within a radius of 20 miles, using 8-inch distributing mains under high pressure. South MacAlister and the region thereof is noted as a coal producing territory, the output from which is in good demand for gas making and steam raising purposes. It is located on the line of the old Missouri, Kansas and Texas Railroad at a point something less than 100 miles northeast of Denison, Texas. The population that Mr. Jones and his associates propose serving might safely be put at 12,000.

MR. JONES also informs us that the electric light and water supply plants of Galena, Kan., have been secured by the syndicate of which he is the head. They propose to construct a gas works there. Galena has a population of 5,500.

THE authorities of Salisbury, Md., are considering a proposition for the construction of a gas works at that point.

MESSRS. FARSON, LEACH & Co., and Devitt, Tremble & Co., of Chicago, have purchased the properties of the Pueblo (Col.) Gas Light Company, and have reincorporated the same under the title of the Pueblo Gas and Fuel Company. The Directors of the succeeding concern are: T. E. Eyman, H. A. Cowan, J. T. McCorkle, J. D. Taylor and C. H. Prall. It is understood that the active management of the concern will be vested in Mr. T. E. Eyman, and it is further put forth that a goodly sum will be invested at once in plant renewals, enlargements, and so on.

THE Messrs. Sawyer, who are the owners of the Company that supplied gas and electric currents to Oshkosh (Wis.) residents are interested in a project for the construction and operation of a gas plant at Berlin, It is rather odd that an enterprise of such nature was not started long ago in Berlin. Located on Fox river, at a point 22 miles south by west of Oshkosh, and on a branch line of the Chicago, Milwaukee and St. Paul Railroad, it is the home of many and diversified manufactures. The place sustains a population of not less than 8,500 people, and grows in importance as a business center in rapid way.

THE Citizens Gas Light and Heating Company, of Findlay, O., through Mr. Wm. V. Coons, has awarded a contract for the construction of a complete artificial gas plant to the Kerr Murray Manufacturing Company, of Fort Wayne, Ind. One item in the contract calls for the erection of a holder up to retaining 500,000 cubic feet.

MR. A. W. UNGER has applied to the authorities of Storm Lake, Ia., for the right to construct and operate a plant for the manufacture and supply of gas in that city. He agrees to charge not in excess of $1.50 per 1,000 cubic feet (in the event that 50 consumers are pledged to purchase a supply) and to have the plant in operation within two years.

THE proprietors of the United Gas and Electric Company, who control the gas, electric and street railway service in the cities of New Albany and Jeffersonville, Ind., have promoted Mr. James W. Dunbar to the important position of General Superintendent. He deserves his promotion.

THE first prize in the public competition instituted by the Springfield (Mass.) Gas Light Company, to be awarded to the one who handed in the best essay on "The advantages of the gas range," the particulars of which contest were given in the JOURNAL some weeks ago, was awarded to Miss Mary T. Wright. She had the option of taking a trip to Europe or accepting $200 in gold, and accepted the latter. She is a graduate of the local high school, and the money earned through her essay is to be expended in securing a scholarship at Mount Holyoke College.

AT the annual meeting of the Greenfield (Mass.) Gas Light Company no change was made in the executive management. Dividends of 3 per cent. for the half year, on the preferred and common stocks, were declared.

MR. ALBERT L. SWETT has secured a controlling interest in the Medina (N. Y.) Gas Company.

THE South Jersey Gas and Electric Company, of Trenton, N. J., is likely to secure control of the Princeton (N. J.) Gas Light Company. At least so we are informed by a prominent Princetonian, who further told us it was no secret that the Trenton capitalists had offered at the rate of $150 per share for the Princeton stock.

WE regret to announce the death of Mr. James T. Basford, whose demise occurred at the home of his parents, 4 Leeds street, Utica, N.Y., the morning of the 1st inst. Deceased had been in the service of the Utica (N. Y.) Gas and Electric Company until last March, when he resigned to accept the position of foreman to the Steelton (Pa.) Home Gas Company, at the urgent invitation of Manager E. A. Pinkney. Mr. Basford was in his 28th year, having been born in Utica, May 7, 1875.

THE corporate name of the Calumet Gas and Electric Company, of Chicago, has been changed to read the Calumet Lighting Company.

THE Gas Engine Ignition Company, of Chicago, has been incorporated with a capital of $30,000 by Messrs. G. A. Ramsay, H. C. Winchell and Paul McGuffin.

POSTVILLE, IA., is to have a gas works. It is likely to be of the acetylene type.

SINCE the Suburban Gas Company secured control of the fortunes of the Media (Pa.) Gas Company, 200 gas stoves have been placed in that thriving borough.

THE Citizens Gas Company, of Kankakee, Ills., is extending its mains to the outlying village of West Kankakee.

THE general offices of the Sacramento (Cal.) Electric, Gas and Railroad Company will shortly be removed to commodious and well arranged quarters in the modern building at the corner of Second and J streets. The business of the Company is increasing at a rate little short of marvellous.

QUITE without the gentleman's knowledge we report the resignation of Mr. H. S. Morgan from the service of the Excelsior Coke and Gas Company, of Topeka, Kan., as its Secretary and Treasurer. He did good work for the Company, since his connection therewith in 1896, and our belief is that his resignation is the preliminary to promotion in a larger community.

MR. A. J. JAECKEL, writing from Washington, Pa., under date of July 31st, says: "The natural results obtaining over the purchase of the Relief Gas Company and of the Mutual Benefit Gas Company by the proprietors of the Manufacturers Light and Heat Company, are being felt. Commencing with the 1st of August, the rate for natural gas supplied in the district is to rule at 22 cents per 1,000 cubic feet, less 2 cents per 1,000 for prompt payment. The schedule means an increase of 8 cents per 1,000 over the heretofore rates; and to tell the truth, I fail to understand why the combination did not send the price to 35 cents per 1,000, less 5 cents for prompt payment. They would do just as much business at the latter rate as at the former."

MR. Z. T. WHITE, the worthy son of his father, has managed to outgame the last kicking shareholder in the properties of the El Paso (Tex.) Gas, Electric Light and Power Company—of course, it is understood that the Gordon interests in the property are with Mr. White.

THE advocates of municipal control in respect of gas lighting supply are respectfully referred to the latest turnover in such instance. The example is that furnished by the Talledega (Ala.) Light and Water Commission, who recently sold the gas end of the outfit to private parties. The new owners will put the plant, by reconstructing it and adding to it, on a basis where it will not only pay to the city taxes but interest to its bondholders.

AT the annual meeting of the Pittsfield (Mass.) Coal Gas Company the officers chosen were: Directors, Robert W. Adam, Wm. R. Plunkett, W. G. Backus, J. W. Hull and George H. Tucker; President, R. W. Adam; Clerk and Treasurer, W. R. Plunkett. The reports of Manager Woodward and Superintendent Dunbar showed plainly, in respect of the resultant profit, that the reconstruction and extension work done some months ago had not been done in vain.

THIS slight reference to the Berkshire district, of Massachusetts, recalls to mind hints, if not suggestions, that Colonel Frank S. Richardson, instead of selling his tidy lighting properties in North Adams, has managed to induce others to sell to him properties of like nature in Adams and Williamstown. Let us hope that fact is behind our chapters of hints and suggestions.

THE long whiskered, portly and more-or-less saintly clergymen and gentlemen who control the rental privileges of Ocean Grove, N. J., having for years kept gas for lighting and cooking out of the reach of occupants of their summer huts, have recently been confronted by a stern proposition in the instance of such supply by Mr. W. B. Tuttle, General Manager of the Consolidated Gas Company, of New Jersey. Mr. Tuttle's Company has its pipes in the streets of Asbury Park, and "there's only one more river to cross"—a miserable arm of the sea—in the way of giving to the Ocean Grove "tenters" a clean means of cooking the queer stuff that most of them eat during revival times. Of course we know that Mr. Andrus prefers to live in Yonkers-on-the-Hudson, N. Y., but because he is an Ocean Grove Trustee, and as such is directly interested in the profits that spring from a monoply ownership in the electric lighting plant doing business in the Grove, is not sufficient reason to prevent him and his associates from turning an honest penny in the sale of gas to the "tenters." He is on the lighting committee of the Grove owners, to whom has been referred the following offer from Mr. Tuttle of the Consolidated Gas Company, of New Jersey:

"Mr. W. L. Meeks: In answer to your letter, in which you and Mr. Ahrens request a proposition from this Company to supply gas in Ocean Grove, would state that the Consolidated Gas Company, in case permission is given by the proper authorities, will agree to lay mains, without charge, in the streets of Ocean Grove, provided, however, that it is not obligatory for this Company to lay mains in any street unless at least one consumer can be obtained for each 100 feet of main laid. This Company further agrees to make all necessary openings in a manner which will cause the least possible inconvenience to the public, and to replace the streets in as good a condition as they were at the time the openings were made. The Consolidated Gas Company, in case permission is given to lay mains and carry on public and private business, further agrees to pay the Ocean Grove Association 2 per cent. of the gross receipts from gas sales in Ocean Grove, this being the tax which is now required to be paid in the various municipalities where this Company operates under the State franchise act. Ocean Grove being private property this Company would not by law be compelled to pay this tax. This Company will moreover agree to lay free services into all buildings and permanent tent sites owned by the Ocean Grove Association, provided such buildings or tent sites are within 100 feet of this Company's mains. This Company will further agree to make no charge either for tapping the mains or for the service pipes from the main to the curb line. A reasonable charge will be made for service pipes from the curb to the house, except for services run for the Ocean Grove Association, as above stated. This Company further agrees to furnish all necessary meters and connections and to bear all expenses incidental to the maintenance of the mains and the supplying of gas, so that the Ocean Grove Association will have no expense from this source. This Company further agrees to furnish gas of the same quality as that furnished by it in Asbury Park, and at a price not to exceed $1.60 per 1,000 cubic feet, subject to a discount of 10 cents per 1,000, provided bills are paid before the 10th of each month. This Company further agrees that whenever any general reduction in the price of gas is made in Asbury Park, the same reduction will be made to your Association and to all other consumers in Ocean Grove. In case the Ocean Grove Association desires to lay its own mains and services and to conduct the business itself, the Consolidated Gas Company will sell gas to your Association at $1 per 1,000 feet at the gate. The above offer must be accepted within 60 days from this date to be binding on our Company. We should be pleased at any time to personally make any further explanation you may desire."

## Petroleum in Foreign Ships.

At the last meeting of the British Institution of Naval Architects a paper was read on "Liquid Fuel for Ships" by a prominent member of Parliament, in which it was stated that the recent discovery of large supplies of fuel oil in Borneo and Burmah and quite recently in Texas and California had changed the whole aspect of the question. With the assurance of continuous supplies it became necessary to treat the question not only as of practical importance, but of urgency. Twenty-five per cent. of the space now occupied by coal bunker storage could be saved by utilizing liquid fuel.

The British Admiralty had determined on exhaustive tests, and their policy was understood to extend to trials not only in destroyers, but also in 3 cruisers and 1 battleship. Some 20 vessels under the British flag are now running regularly under liquid fuel, and at least a dozen are building with suitable fuel apparatus included in their design. The Italian Admiralty were, he said, studying the question.

The German government has used liquid fuel on the China station for many months in lieu of coal for auxiliary purposes on board ship. The Hamburg-American Company has fitted four and the Norddeutscher Lloyd two vessels for liquid fuel. Dutch mail and cargo steamers in the Far East have liquid fuel in regular use.

Danish owners have ordered the building of two steamers to burn liquid fuel. Storage arrangements had already been made in 31 ports, and further storage arrangements were projected in South Africa and South American ports. Ports east of the Canal were to be supplied with oil from Borneo and Rangoon, and west of the Canal and in South America from Texas and California fields. East of the Suez Canal, Borneo oil could beat coal, and there appeared, he said, no reason to doubt that ports in the western hemisphere could be supplied with oil from Texas at a cost not proportionately exceeding that of coal. Adopting the proportion of 3 tons coal equal to 2 tons oil fuel, he estimated that there would be a gain in weight of about 1,000 tons in the freight of a first-class Atlantic steamer, and a gain of nearly the whole of the bunker space. He dealt at length with other advantages in using liquid fuel.

In the discussion which followed the reading of this paper, the President, the Earl of Glasgow, said that he was sure there was a large field of petroleum in Egypt on the borders of the Red Sea, which would be a great convenience to vessels going through the Canal which wanted that fuel. Mr. J. Melrose, Chief Inspector of Machinery at the Admiralty, said that water intermixed with the oil injured the boilers, and the amount of water which might be present with the oil varied from 3 to 40 per cent. The water extinguished the burners, and if the latter were not re-ignited and the oil still continued to flow an explosion might be caused. Sir Fortescue Flannery, in replying, said that it was of the utmost importance to get rid of steam for purposes of pulverizing the oil if it were possible. Two twin screw steamers were being built to be driven by liquid fuel, one to have steam apparatus, with a view of getting the best comparative results. He concluded by stating that he believed liquid fuel had a very great future before it.

## The Market for Gas Securities.

Contrary to expectation, and to our prediction of last week as well, when it was suggested that the local gas share market had settled down to the usual spell of midsummer dullness, the trading in Consolidated for this week was quite lively. The dealings were all made at slightly better prices, and the net result is a gain of a point. There was nothing out of the common to account for the spurt and the increase in values, although it may safely be said that Consolidated is not selling at anything like the values that are behind it.

Brooklyn Union is steady. The Directors have declared a dividend of 2 per cent, payable September 2. The books close the 14th inst., and their reopening is set for the 2d prox. The shorts in Peoples Gas, of Chicago, suffered some pain over a brisk rise in the shares. The net gain for the week in the bid price is 2¼ points. Syracuse gas is moving upward, and its friends are predicting 35 for it before election day. Washington (D. C.) gas is 355 bid. There is no change in Bay State; Mr. Lawson's horse did not win. Baltimore Consolidated is steady.

## Gas Stocks.

**Quotations by George W. Close, Broker and Dealer in Gas Stocks.**
**16 Wall Street, New York City.**
August 11.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

| *N. Y. City Companies.* | *Capital.* | *Par.* | *Bid.* | *Asked.* |
|---|---|---|---|---|
| Consolidated | $73,177,000 | 100 | 224½ | 225 |
| Central Union, Bonds, 5's. | 3,000,000 | 1,000 | 110 | 112 |
| Equitable Bonds, 6's | 1,000,000 | 1,000 | 105 | .. |
| " 1st Con. 5's | 2,300,000 | 1,000 | 118 | 120 |
| Metropolitan Bonds | 658,000 | .. | 108 | 112 |
| Mutual | 3,500,000 | 100 | 350 | .. |
| Municipal Bonds | 750,000 | .. | .. | .. |
| New Amsterdam Gas Co. .. Bonds, 5's | 11,000,000 | 1,000 | 112½ | 113 |
| Northern Union, Bonds, 5's. | 1,250,000 | 1,000 | 108 | 110 |
| New York and East River Bonds 1st 5's | 3,500,000 | 1,000 | 112 | 113 |
| " 1st Con. 5's | 1,500,000 | . | 109 | 111 |
| Richmond Co., S. I. | 348,650 | 50 | 100 | .. |
| " Bonds | 100,000 | 1,000 | 103 | . |
| Standard | 5,000,000 | 100 | 130 | 140 |
| Preferred | 5,000,000 | 100 | 150 | 160 |
| Bonds, 1st Mortgage, 5's | 1,500,000 | 1,000 | 114 | 117 |
| Yonkers | 299,650 | 500 | 130 | . |
| *Out-of-Town Companies.* | | | | |
| Brooklyn Union | 15,000,000 | 100 | 235 | 240 |
| " " Bonds (5's) | 15 000,000 | 1,000 | 119 | 119½ |
| Bay State | 50,000,000 | 50 | 1¾ | 2 |
| " Income Bonds | 2,000,000 | 1,000 | . | 75 |
| Binghamton Gas Works. . | 450,000 | 100 | 28 | 30 |
| " 1st Mtg. 5's | 509,000 | 1,000 | 93 | 96 |
| Boston United Gas Co.— 1st Series S. F. Trust | 7,000,000 | 1,000 | 82 | 85 |
| 2d " " " | 3,000,000 | 1,000 | 47½ | 50 |
| Buffalo City Gas Co. | 5,500,000 | 100 | 11 | 13 |
| " " Bonds, 5's | 5,250,000 | 1,000 | 88¾ | 85 |
| Capital, Sacramento | 500,000 | 50 | .. | 35 |
| Bonds (6's) | 150.000 | 1,000 | | |
| Central San Francisco | 2,000,000 | .. | 106 | 108 |
| Chicago Gas Co. Guaranteed Gold Bonds | 7.650.000 | 1,000 | 104 | 104¼ |
| Cincinnati Gas & Elec. Co. | 20,500,000 | 100 | 102½ | 102¾ |
| Columbus (O.) Gas Co., 1st Mortgage Bonds | 1,500,000 | 1,000 | 108 | 109 |
| Columbus (O.) Gas Lt. & Heating Co | 1,682,750 | 100 | 88¼ | 89½ |
| Preferred | 3,026,500 | 100 | 107½ | 109 |
| Consumers, Jersey City Bonds | 600,000 | 1,000 | 102 | 103 |
| Consumers, Toronto | 1,700,000 | 50 | 218 | 225 |
| Consolidated, Baltimore | 11,000,000 | 100 | 70 | 70¼ |
| Mortgage, 6's | 3,600,000 | .. | .. | 118 |
| Chesapeake, 1st 6's | 1,000,000 | .. | .. | .. |
| Equitable, 1st 6's | 910,000 | .. | .. | .. |
| Consolidated, 1st 5's | 1,490 000 | | . | 112 |
| Consolidated Gas Co. of N.J. | 1,000,000 | 100 | 15 | 17 |
| " Con. Mtg. 5's | 380,000 | 1,000 | 85 | 87 |
| Consolidated G. & E. Co.'s, Little Falls, N.Y. | 90,000 | 100 | .. | 100 |
| Bonds | 75,000 | .. | .. | 100 |
| Detroit City Gas Co | 4,825,500 | 50 | . | 89 |
| " Prior Lien 5's | 5,603,000 | 1,000 | 99½ | 100 |
| Detroit Gas Co., 5's | 382,000 | 1,000 | 77 | 79 |
| " Inc. 5's | 16,000 | 100 | 94 | 94½ |
| Equitable Gas & Fuel Co., Chicago, Bonds | 2,000,000 | 1,000 | .. | 101 |
| Essex and Hudson Gas Co. | 6,500,000 | .. | 34 | 38 |
| Fort Wayne | 2,000,000 | .. | . | . |
| " Bonds | 2,000,000 | .. | 58 | 63 |
| Grand Rapids Gas Lt. Co. 1st Mtg. 5's | 1,225,000 | 1,000 | 104½ | 105 |
| Hartford | 750,000 | 25 | 245 | 265 |
| Hudson County Gas Co., of New Jersey | 10,500,000 | .. | 25 | .. |
| " Bonds, 5's | 10,500,000 | .. | 101 | 103 |
| Indianapolis | 2,000,000 | .. | 70 | 80 |
| " Bonds, 6's | 2 650,000 | .. | 102¾ | 104⅜ |
| Jackson Gas Co. | 250,000 | 50 | 73 | 75 |
| " 1st Mtg. 5's | 290,000 | 1,000 | 101 | 102½ |
| Kansas City Gas Light Co., of Missouri | 5,000,000 | 100 | .. | 36 |
| Bonds, 1st 5's | 3,822,000 | 1,000 | 102 | 104 |
| Laclede, St. Louis | 10,000,000 | 100 | 86 | 89 |
| Preferred | 2,500,000 | 100 | 100 | 110 |
| Bonds | 10,000,000 | 1,000 | 109½ | 110 |
| Lafayette Gas Co., Ind. | 1,000,000 | 100 | | 60 |
| Bonds | 1,000,000 | 1,000 | 58 | 64 |
| Louisville | 2,570,000 | 50 | 112 | 120 |
| Madison Gas & Elec. Co. " 1st Mtg. 6's | 350,000 | 1,000 | 107½ | 109½ |
| " 6 per cent. scrip, due 1910 | 100,000 | 25 | 25 | 87 |
| Montreal, Canada | 2,000,000 | 100 | 182 | 184¾ |
| Newark, N. J., Con. Gas Co Bonds, 6's | 6,000,000 | .. | 56 | 58 |
| New Haven | 1,000,000 | 25 | 300 | 325 |
| Nashville Gas Lt. Co. | 1,000,000 | 100 | 110 | .. |
| Oakland, Cal. | 2,000,000 | .. | 46 | 47 |
| " Bonds | 750,000 | .. | .. | .. |
| Peoples G. L. & Coke Co., of Chicago | 25,000,000 | 100 | 105⅞ | 106 |
| Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage | 30,100,000 | 1,000 | .. | .. |
| 2d " | 2,500,000 | 1,000 | 104 | |
| Rochester Gas & Elec. Co. | 2,150,000 | 50 | 88 | . |
| Preferred | 2,150,000 | 50 | 118 | .. |
| Consolidated 5's | 2,000,000 | .. | 87½ | 90 |
| San Francisco, Cal. | 10,000,000 | 100 | 48 | 48½ |
| St. Paul Gas Light Co. | 1,500,000 | 100 | 45 | 47 |
| 1st Mortgage 6's | 650,000 | 1,000 | 113 | 116 |
| Extension, 6's | 600,000 | 1,000 | 113½ | 115 |
| General Mortgage, 5's | 2,465,000 | 1,000 | 92 | 93 |
| St. Joseph Gas Co. " 1st Mtg. 5's | 751,000 | 1,000 | 95 | 96½ |
| Syracuse, N. Y. | 1,975,000 | 100 | 27 | 30 |
| Bonds | 2,047 000 | 1,000 | 86 | 90 |

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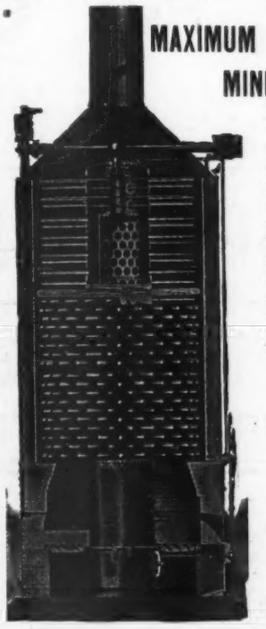

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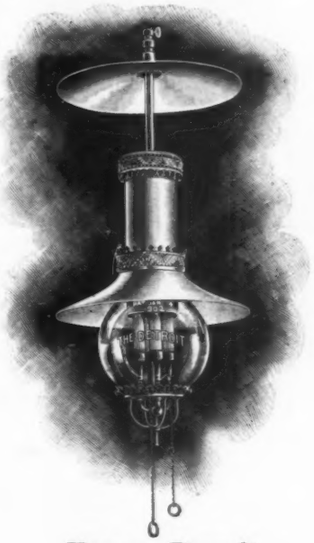

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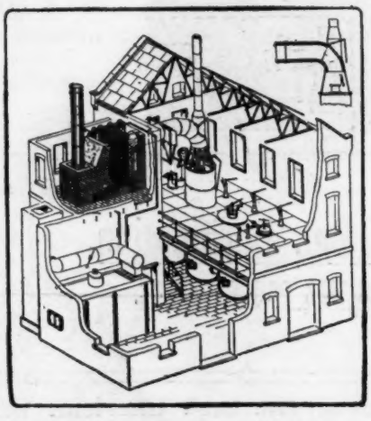

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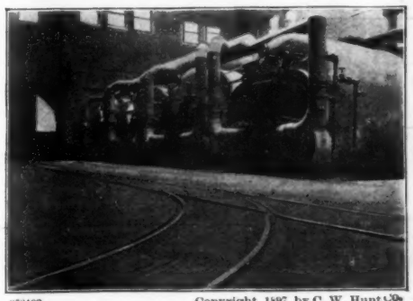

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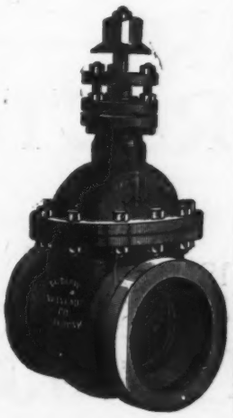

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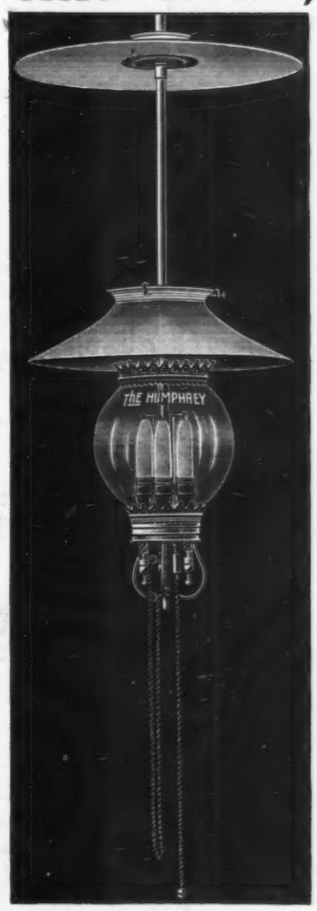


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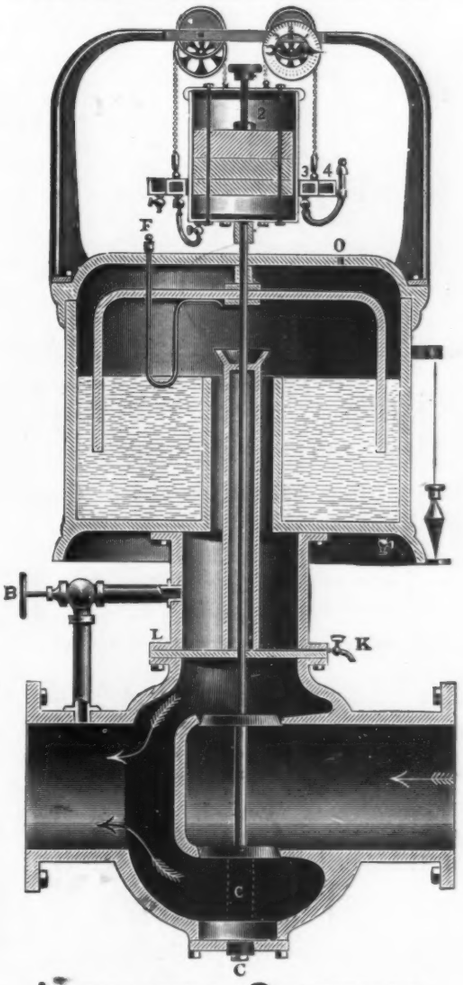


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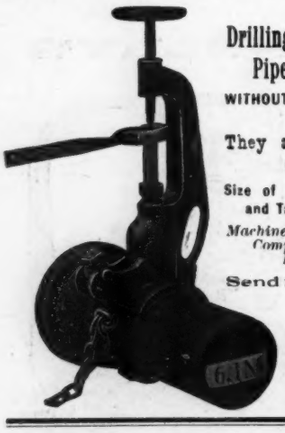

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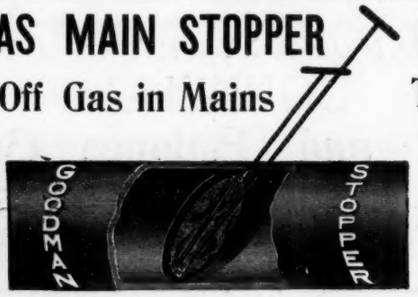


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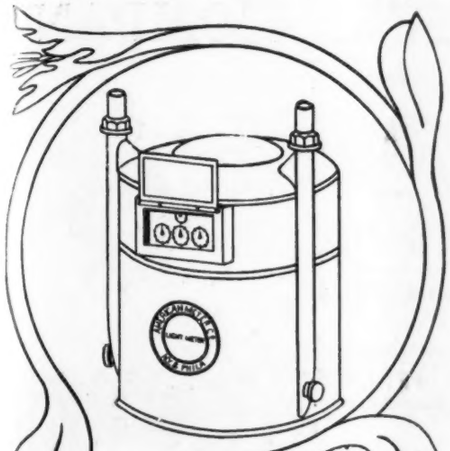

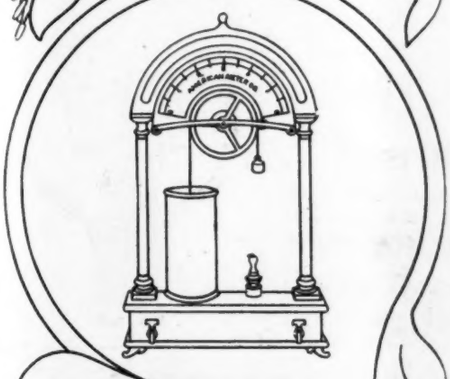

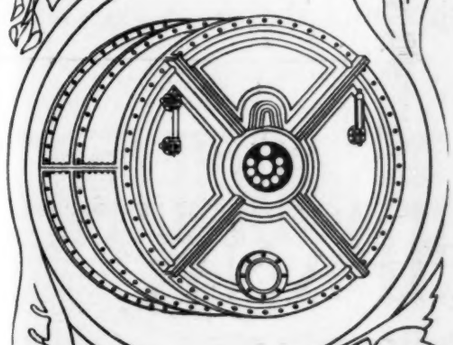

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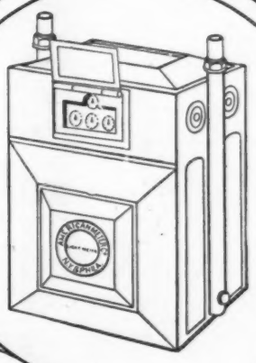

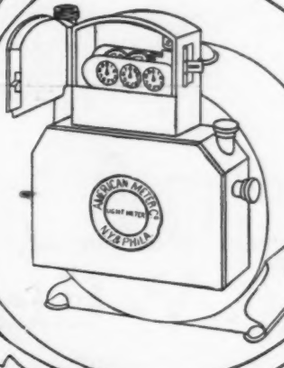

## PUBLIC LIGHTING TABLE.

### AUGUST, 1902.

| Day of Week. | Date. | Table No. 1. Following the Moon. Light. | Table No. 1. Following the Moon. Extinguish. | Table No. 2. New York City. All Night Lighting. Light. | Table No. 2. New York City. All Night Lighting. Extinguish. |
|---|---|---|---|---|---|
| | | | | P.M. | A.M. |
| Fri. | 1 | 7.50 PM | 4.00 AM | 7.10 | 3.30 |
| Sat. | 2 | 7.50 | 4.00 | 7.10 | 3.30 |
| Sun. | 3 | 7.40 NM | 4.00 | 7.10 | 3.30 |
| Mon. | 4 | 7.40 | 4.00 | 7.10 | 3.30 |
| Tue. | 5 | 7.40 | 4.00 | 7.10 | 3.30 |
| Wed. | 6 | 7.40 | 4.00 | 7.10 | 3.45 |
| Thu. | 7 | 7.40 | 4.00 | 7.10 | 3.45 |
| Fri. | 8 | 8.40 | 4.00 | 7.10 | 3.45 |
| Sat. | 9 | 9 20 | 4.00 | 7.10 | 3.45 |
| Sun. | 10 | 9.50 FQ | 4.10 | 7.10 | 3.45 |
| Mon. | 11 | 10.30 | 4.10 | 7.10 | 3.45 |
| Tue. | 12 | 11.10 | 4.10 | 7.10 | 3.45 |
| Wed. | 13 | 12.00 | 4.10 | 6.55 | 4.00 |
| Thu. | 14 | 12.50 AM | 4.10 | 6.55 | 4.00 |
| Fri. | 15 | 1.40 | 4.10 | 6 55 | 4.00 |
| Sat. | 16 | 2.40 | 4.10 | 6.55 | 4.00 |
| Sun. | 17 | No L. | No L. | 6.55 | 4.00 |
| Mon. | 18 | No L. FM | No L. | 6.55 | 4 00 |
| Tue. | 19 | No L. | No L. | 6.55 | 4.00 |
| Wed. | 20 | 7.20 PM | 8.20 PM | 6.45 | 4.10 |
| Thu. | 21 | 7.20 | 8.50 | 6.45 | 4.10 |
| Fri. | 22 | 7.20 | 9.30 | 6.45 | 4.10 |
| Sat. | 23 | 7.20 | 10.00 | 6.45 | 4.10 |
| Sun. | 24 | 7.10 | 10.40 | 6.45 | 4.10 |
| Mon. | 25 | 7.10 LQ | 11.30 | 6 45 | 4.10 |
| Tue. | 26 | 7.10 | 12.20 AM | 6 45 | 4.10 |
| Wed. | 27 | 7.10 | 1.20 | 6.30 | 4.20 |
| Thu. | 28 | 7.10 | 2.20 | 6.30 | 4.20 |
| Fri. | 29 | 7.10 | 4.20 | 6.30 | 4.20 |
| Sat. | 30 | 7.10 | 4.20 | 6.30 | 4.20 |
| Sun. | 31 | 7.00 | 4.30 | 6 30 | 4.20 |

### TOTAL HOURS LIGHTING DURING 1902.

| By Table No. 1. | Hrs. Min. | By Table No. 2. | Hrs. Min. |
|---|---|---|---|
| January | 238.30 | January | 423.20 |
| February | 196.20 | February | 355.25 |
| March | 196.20 | March | 355.35 |
| April | 166.40 | April | 298.50 |
| May | 151.40 | May | 264.50 |
| June | 131.10 | June | 234.25 |
| July | 142.40 | July | 243.45 |
| August | 162.00 | August | 280 25 |
| September | 179.00 | September | 321.15 |
| October | 216.30 | October | 374.30 |
| November | 224.10 | November | 401.40 |
| December | 250.00 | December | 433.45 |
| Total, yr. | 2255.00 | Total, yr. | 3987.45 |

NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

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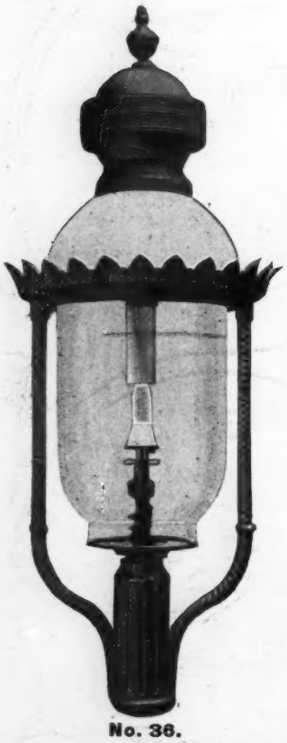
.... OF AMERICA ....



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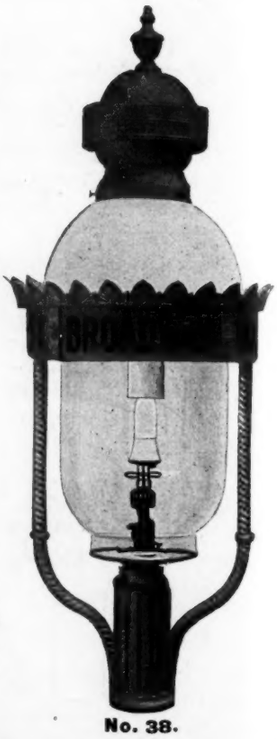

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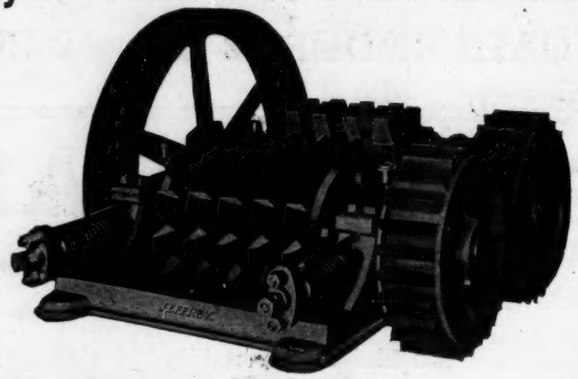

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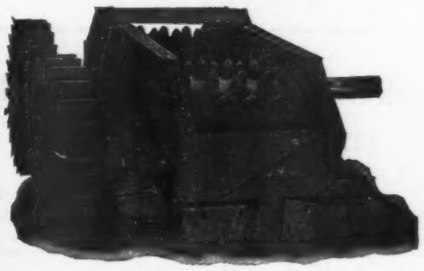

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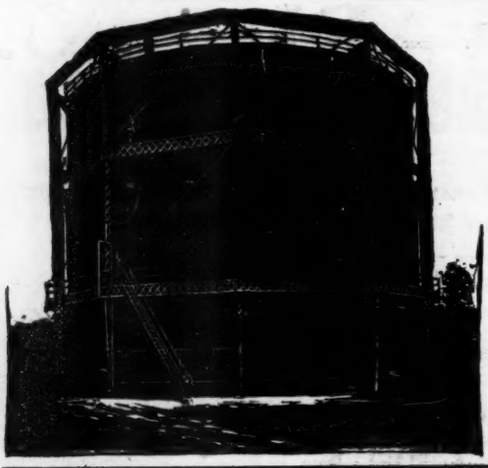

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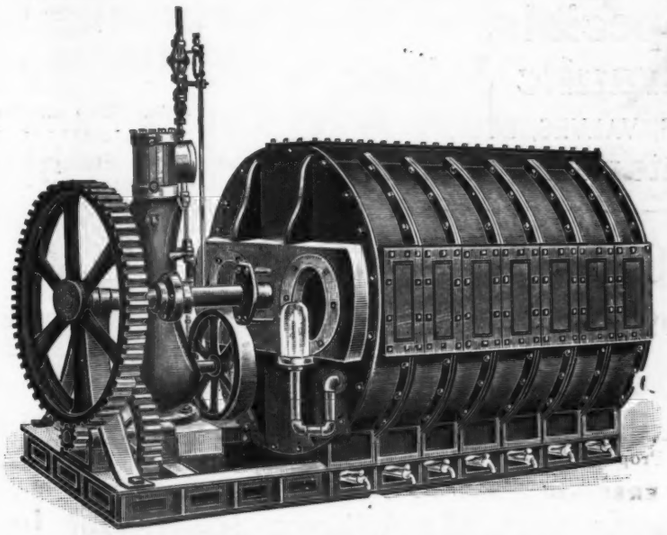

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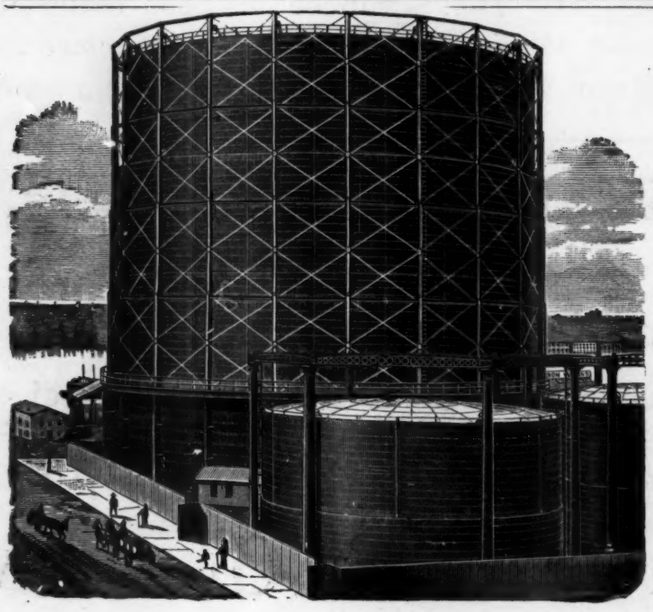

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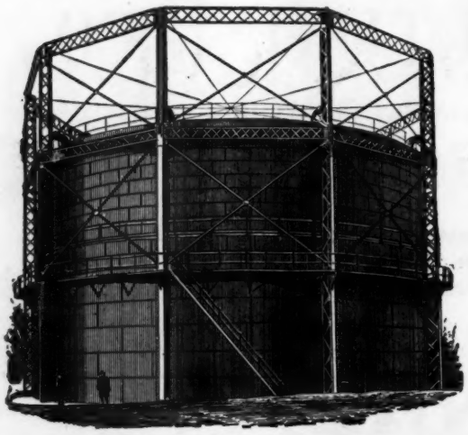

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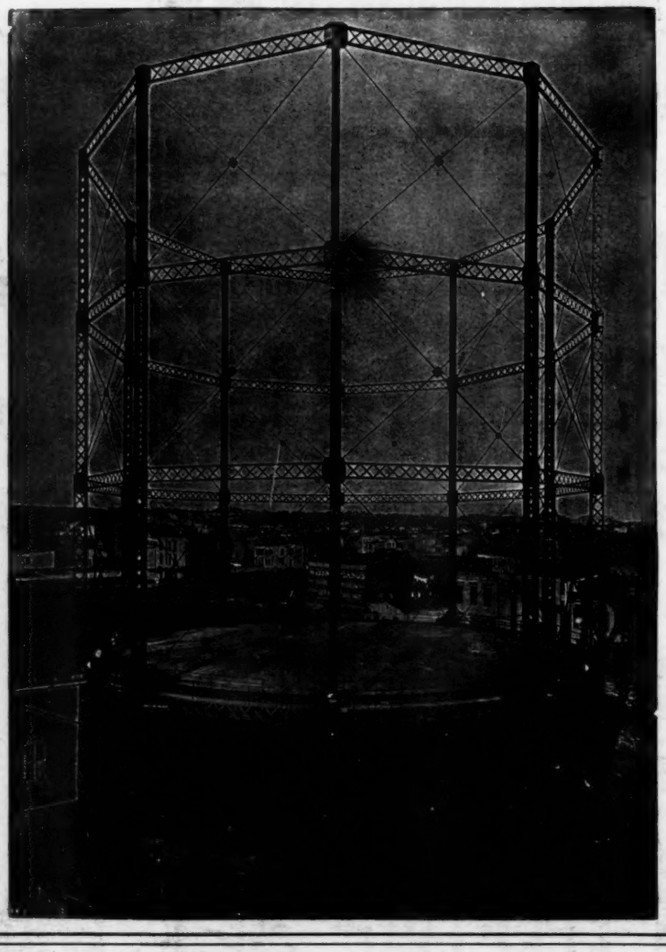

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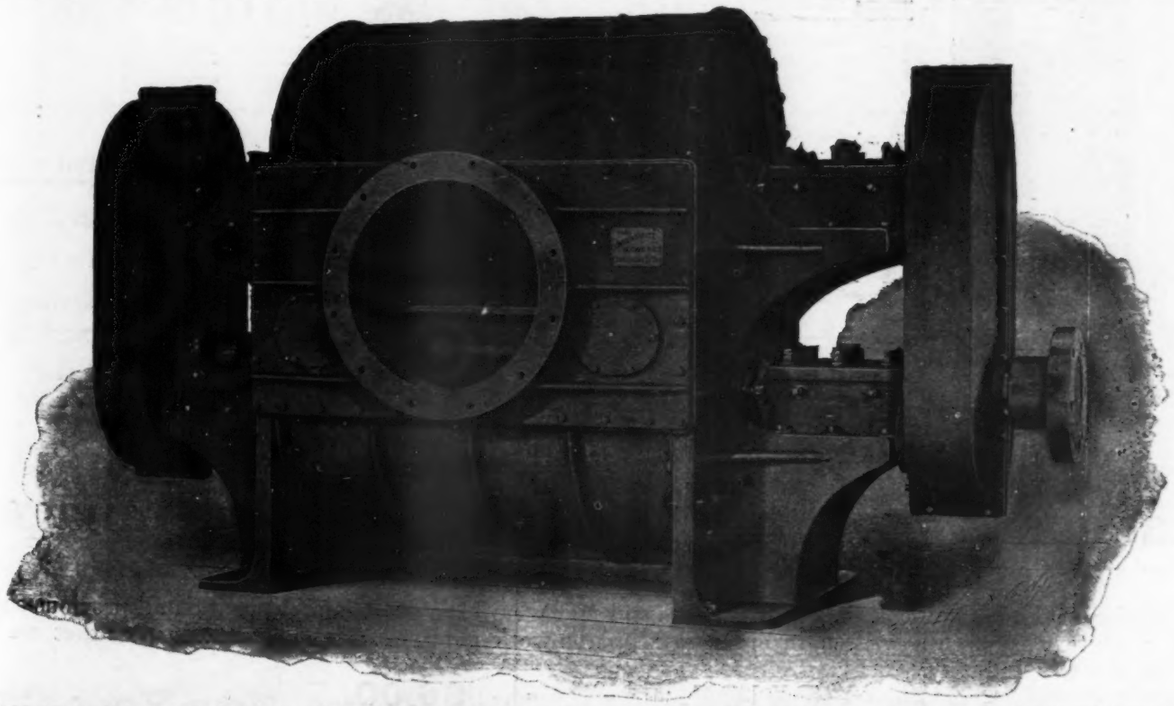

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